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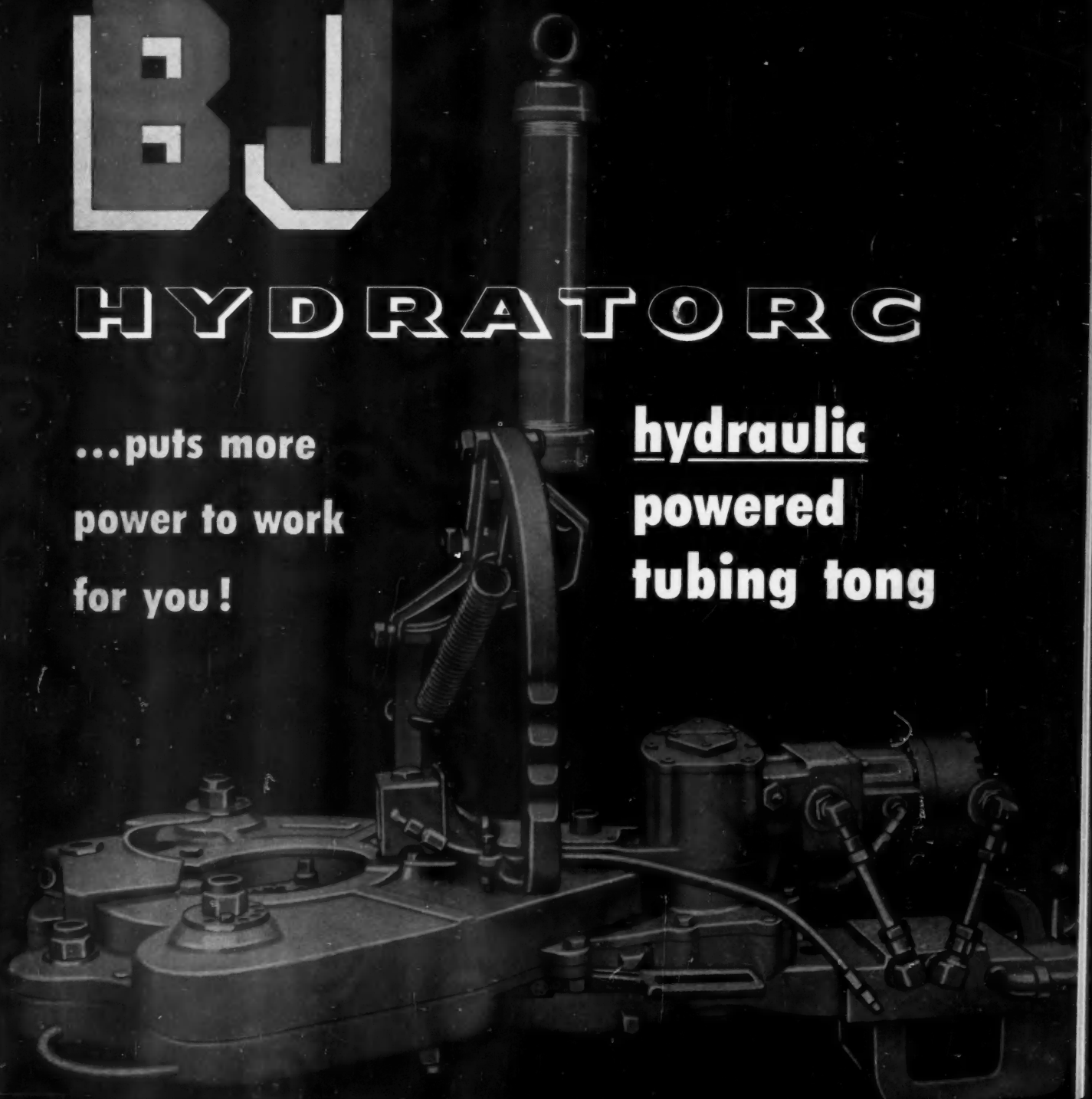

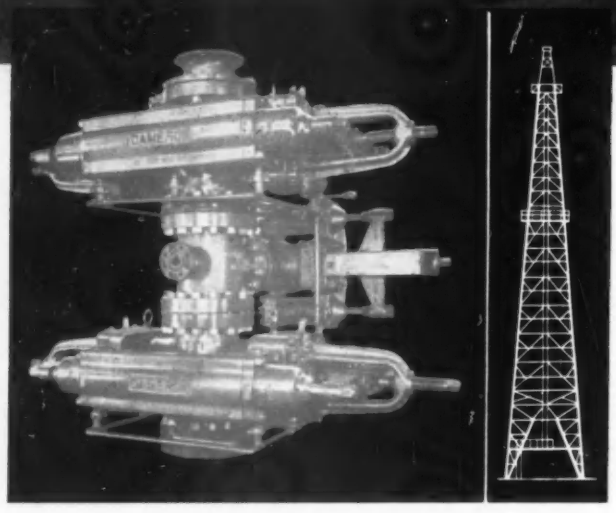

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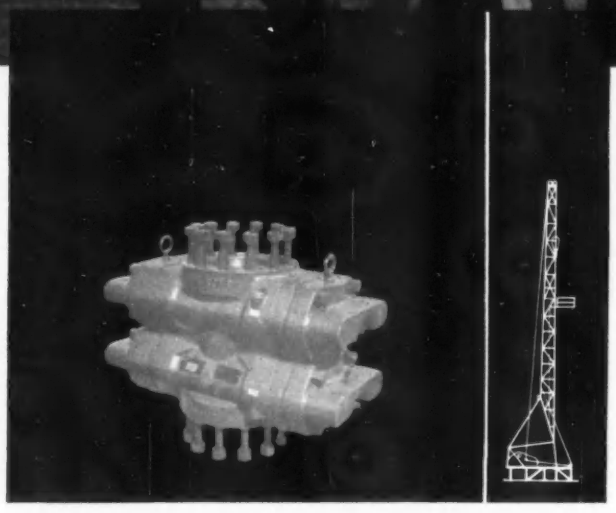

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January, 1955

CURRENT OUTLOOK SECTION

Looking Ahead ... 37
Publisher's Page ... Ray L. Dudley 39
Texas Independents Propose United Front on Imports ... Al Reese 40
Who's Making U. S. Oil Imports? ... L. J. Logan 41
Chances Good of Amending Gas Act ... 43
Industry Leaders See Bright Year Ahead ... If ... 44
Oil Industry Plant, Equipment Outlay to Soar ... Don Kliewer and Cecil W. Smith 49
Up Goes a New Rig for a Look Below the Sea ... 50
World Demand May Reach 15 Million Barrels ... Robert E. Spann 52
The Changing Panorama ... 58
Report from the Observatory ... Ray L. Dudley and Warren L. Baker 62
Petroleum Trends in U. S. ... Cecil W. Smith 64
WORLD OIL's Views of the News ... 66
The Month's Completions ... 72

EXPLORATION SECTION

Water Analyses Help Identify Formations ... John F. Sage 75
Deltas Significant in Subsurface Exploration (Part 2) ... Daniel A. Busch 82
Exploration Ahead of 1953 ... Cecil W. Smith 88
U. S. Discoveries in November ... 90

DRILLING SECTION

A Special Report on Air and Gas Drilling ... 109
In Colorado: How Air and Gas Drilling Aided Wildcat Operations ... L. S. Fuller and Dale E. Lockett 110
In Pennsylvania: Lost Circulation and Completion Problems Eased ... H. J. Magner 116
In New Mexico: Air-Drilled Well Compared With Well Drilled With Mud ... R. D. Lemmons and K. J. Barr 124
In West Texas: Findings from Four Wells ... Earl Bruno 132
In California: Faster Penetration Rates and Completion Advantages Seen ... Gilbert M. Wilson 143
Keys to Successful Competitive Drilling—A Series on Modern Drilling Technology (Part 3); The Importance of Rock Bit Size ... Roy A. Bobo, Robert S. Hoch and George S. Ormsby 152
How to Do It—Drilling Hints ... 166

PRODUCTION SECTION

Graphic Wattmeters Used to Balance Pumping Cycle ... Rex N. Brown 177
Acidizing in Undeveloped Areas ... R. E. Hurst and D. E. Ramsey 188
New Device Determines Optimum Conditions for Multi-Stage Separation ... Paul J. Kalish 194
Water-Flooding and Gas Cycling Affected by Horizontal Fractures in Thin Reservoirs ... Dr. Paul B. Crawford 204
How to Do It—Production Hints ... 211

INTERNATIONAL SECTION

Who Controls Crude Reserves Outside U. S.? ... Robert E. Spann 221
Old Tampico Days Recalled Once a Year by Unique Club ... Don Kliewer 223
Luxury on the Llanos—A Camp City Profile ... James Joseph 224
What's Happening Among World Oil Men ... 231
A WORLD of OIL ... Don Kliewer 232

DEPARTMENTS

Who's Meeting Where ... 34
What's Happening Among Men in the Industry ... 237
Companies in the News ... 244
What's Happening Among Industry Associations ... 246
What's Happening Among Service and Supply Men ... 248
Trading Post ... 254
Squeaks from the Bullwheel ... 256
New Books, Maps and Movies ... 266

NEW EQUIPMENT SECTION

What's New in Equipment ... 260
New Equipment Literature ... 264
Advertisers' Index ... 268

a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK ARTICLES

☐ **Texas independents are in belligerent accord** for the first time in 25 years. Meeting in Fort Worth last month, they drafted a program designed to rally nationwide support for legislative restrictions on imports. **Page 40. Texas Independents Propose United Fronts on Imports** ... **Al Reese**

☐ **Even some importers are critical** of the volumes of foreign oils currently being brought into the U. S. They defend their own receipts as reasonable but hint that other concerns are not practicing equal moderation. WORLD OIL in this issue shows who is importing the oils, by companies, and how the current imports of different companies compare with their receipts in prior years, going back to the end of World War II. **Page 41. Who's Making U. S. Oil Imports** ... **L. J. Logan**

☐ **Legislation vital to industry** soon will be introduced in the new Congress. Will the Natural Gas Act be amended? The chances are good. But the fight will be epochal. In the Senate, the balance of power

Turn the Page ➧

THIS MONTH . . .

will rest with 41 uncommitted Senators. The outlook in the House is vague at best. Don't miss this on-the-spot analysis of one of the most critical legislative struggles ever faced by our industry. **Chances Are Good of Amending Gas Act**.....**Page 43**

☐ **Two grave problems face industry** as the new year begins. As the presidents or board chairmen of eight great companies see it, government interference must be thwarted and supply and demand brought more nearly into balance. Here is a penetrating analysis of some of industry's major problems and a thoughtful forecast of prices, earnings and inventories. **Industry Leaders See Bright Year Ahead . . . If**.....**Page 44**

☐ **Plant and equipment expenditures** of the domestic oil industry may soar to a total of $4444 million for 1955 if the trend continues as reported on the basis of the Commerce Department's Office of Business Economics. See **Page 49. Oil Industry Plant, Equipment Outlay to Soar**....**Don Kliewer and Cecil Smith**

☐ **World oil demand** is due to continue on the upgrade. An anticipated high level of industrial activity in Western Europe is expected to continue the trend toward greater increase in petroleum demand in areas outside the U. S. See **Page 52. World Demand May Reach 15 Million Barrels**.....**Robert E. Spann**

EXPLORATION ARTICLES

☐ **Water can be helpful.** By maintaining complete analyses of waters from all drilling wells in a particular field or area and then filing them under a suitable pattern system, the geologist has a valuable tool in geologic correlation. Besides a description of a basic method of water analysis, the article beginning on **Page 75** presents graphic examples of the application of a water pattern system which will help in building up a file of analyses and patterns containing information on all formation waters. **Water Analyses Help Identify Formations**.....**John F. Sage**

☐ **In developing oil and gas production** from lenticular sand bodies, some of the hazards of selecting drilling locations may be reduced by recognizing the possibility that the sand deposits may be associated with ancient deltas. Many lenticular sand bodies are closely related to deltaic environment of deposition. These lenticular sands consequently may be distributed paralled to traces of ancient shorelines. Exploratory and development work in connection with lenticular sands therefore may be greatly aided by a better understanding of deltas and more accurate analysis of pools related to ancient deltas. See **Page 82** for the second part of . . . **Deltas Significant in Subsurface Exploration**..**Daniel A. Busch**

AIR DRILLING IN PENNSYLVANIA. An exhaust flow line is laid on each side of the rig from the rotating head to a point approximately 400 feet from the rig. Here the exhaust line is

A SPECIAL REPORT ON

☐ **Air drilling techniques,** including their use for aerating fluid columns, someday will be put in harness alongside mud drilling to carry a proportional share of total footage drilled. Believing that now's the time to learn how and where air and gas drilling can be used, WORLD OIL this month has devoted the major portion of the drilling section to **A Special Report on Air and Gas Drilling.** On **Page 199** are some introductory remarks by Drilling Editor Philip McLaughlin and a detailed contents of the section. In this report

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shown looking toward the rig (left) and away from rig (right). See **Lost Circulation and Completion Problems Eased in Pennsylvania, Page 116.**

AIR/GAS DRILLING

you'll find authoritative reviews of air and gas drilling . . .

- **In Colorado** where El Paso Natural Gas Company has extended air and gas drilling techniques to wildcat operations. Using a mobile compressor and air drilling engineering service, they have discovered some benefits from air drilling. See **Page 110. How Air and Gas Drilling Aided Wildcat Operations . . L. S. Fuller and Dale E. Lockett**

- **In Pennsylvania** air and gas drilling has been found particularly applicable in the Appalachian Basin. This article offers case history experience of one drilling company while drilling ratholes and surface holes with air and gas, drilling under surface to producing formation with air, and drilling into gas pay with gas. A comparison of penetration rate and description of problems encountered are explained. See **Page 116. Lost Circulation and Completions Problems Eased . . . H. J. Magner**

- **In New Mexico** a comparison is drawn in an engineering study of two wells—one drilled with air and the other drilled with mud. Here's a comprehensive comparison between air and mud drilling including equipment, penetration rates, and detailed costs. See **Page 124. Air-Drilled Well Compared With Well Drilled With Mud . . . . R. D. Lemmons and K. J. Barr**

- **In West Texas** a comparison of four wells points up some of the advantages of air and gas drilling. The author offers evidence that indicates that bit footage and penetration rates are drastically increased when air or gas is used as a drilling medium. See **Page 132. Here Are the Findings from Four Wells . . Earl Bruno**

- **In California** air and gas drilling has played an important part in the drilling-in and completing of wells. Higher productivity of wells has been evidenced because of closer completions. Double drill pipe strings have been developed as a special application for air and gas drilling techniques since complete control over the circulating volume is possible at all times. Nitrogen gas has been tried as a substitute for either air or gas in conjunction with double drill pipe strings. By eliminating combustible mixtures, this technique holds economic promise. See **Page 143. Faster Penetration Rates, Completion Advantages Seen . . . Gilbert M. Wilson**

☐ **More on slim hole drilling.** Information contained in this outstanding article may give the answer to slim hole drilling as far as rock bits are concerned. For those who are considering the use of air with slim hole techniques, here are many answers. This information will lead to the most economical selection of casing and hole size, bits and rig equipment. This information is published here for the first time. See **Page 152.** It's Part 3 in the popular series on **Modern Drilling Technology . . . . . Roy A. Bobo, Robert S. Hoch and George S. Ormsby**

PRODUCTION ARTICLES

☐ **Lower electrical power costs** per barrel of fluid produced can be realized in low gas-oil ratio and low bottom-hole pressure fields by balancing the time cycle in electrically-powered pumping wells. The graphic wattmeter has been used to make these time cycle tests in the South Texas Plains area. How the tests were conducted, results and comparisons of power demand for the balanced and unbalanced well are told in the article starting on **Page 177. Graphic Wattmeters Used to Balance Pumping Cycle . . . . . Rex N. Brown**

Turn the Page

THIS MONTH . . .

☐ **What's the best acid treatment** for a new well in an undeveloped area? Undoubtedly this problem has been faced by every operator who has made a new oil discovery. In the early days of acidizing much was left to trial and error. Today, modern technology has provided the acidizing engineer with the tools to evaluate a new well and arrive at a logical and effective treatment. What factors must be known? How are they obtained? What are some of the tests made to determine the best acid treatment? These are some of the questions answered. See **Page 188. Acidizing in Undeveloped Areas**.....**R. E. Hurst and D. E. Ramsey**

☐ **More for your multi-stage separation** is possible if you operate your separation equipment at the right conditions. What is the right pressure for each stage and how can they be determined? A new device, tested and found highly accurate, utilizes a small sample to make these tests. Equally important, these tests supply accurate formation volume factors for reserve studies. For more details turn to **Page 194. New Device Determines Optimum Conditions for Multi-stage Separation**.....**Paul J. Kalish**

☐ **Planning to water-flood a thin reservoir** produced by wells which have been fractured? This series on the subject is intended to give some prime considerations to performance and sweep efficiencies where horizontal fractures are involved. Part 5, which begins on **Page 204,** summarizes a potentiometric model study on the sweep efficiencies of the direct line-drive pattern in **Gas Cycling Affected by Horizontal Fractures in Thin Reservoirs**.....**Dr. Paul B. Crawford**

INTERNATIONAL ARTICLES

☐ **Who controls crude reserves** outside the U. S.? Turn to **Page 221** for a quick glance at the answer and for proof of the advantage of completely private capital operations.....**Robert E. Spann**

☐ **The Tampiqueno Club** meets but once a year. But its Cinco de Mayo reunion brings together hundreds of oil company and oil field associates who helped shape history in Mexico back in the 1920's and before. Turn to **Page 223** for a brief look into the club, how it started, what success it has had. Its members live throughout the world, but they all share at least one thing in common—their fond remembrances of the days of Old Tampico. **Old Tampico Days Recalled Once a Year by Unique Club**.....**Don Kliewer**

☐ **A Camp City Profile.** Mene Grande has an oil camp in Venezuela called San Tomé. It's known by many descriptive names by those who have found living on the llanos can be a luxury. Turn to **Page 224** to learn why so many veteran employes and their families call it "home." **Luxury on the Llanos**..**James Joseph**

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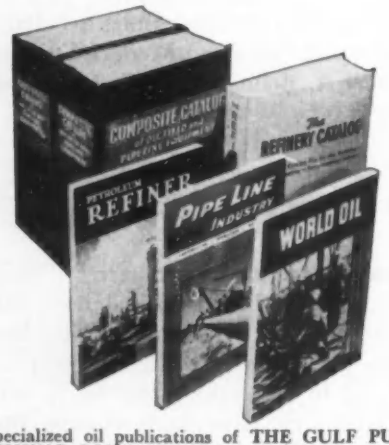

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Warren L. Baker, Editor and Editorial Director; Al Reese, Managing Editor; L. J. Logan, Associate Editor; Wallace Fitzgerald, Assistant to Managing Editor; Cecil W. Smith, Statistical Editor; Philip L. McLaughlin, Drilling Editor; J. E. Kastrop, Production Editor; Don Kliewer, International Editor.

District Editors: Robert E. Spann, 250 Park Ave., New York 17, N. Y.; Gilbert M. Wilson, W. W. Wilson Building, Huntington Park, Calif., and Anthony Gibbon, Hunt Building, Tulsa 3, Okla.
Editorial Assistants: Mary Stuart Warren, Theresa E. Capp.
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R. M. de Sombre, Manager.

ADVERTISING STAFF

Tom W. Nelson, Advertising Manager; D. S. Craig, Advertising Service Manager. *Representatives:* NEW YORK (17): Gene Hart, George Skelton, Nelson Bigelow, 250 Park Ave., Phone El Dorado 5-4012; CLEVELAND (15): Bill Westfall, 1010 Euclid Ave., Phone MAin 1-2550; CHICAGO (4): H. G. Fitzpatrick, Martin Halloran, 332 So. Michigan Ave., Phone Wabash 2-9330; LOS ANGELES: Jay Curts, W. W. Wilson Bldg., Huntington Park, Phone Jefferson 1219; TULSA (3): Bill Atcheson, Jim Isaacks, Hunt Bldg., Phone 3-1844; HOUSTON (6): Charles Wyatt, Clair Bryan, Jr., 3301 Buffalo Drive, Phone LYnchburg 4301; EUROPEAN: Theodor Miocha, Limmerstrasse 31, Hannover, Germany, Phone 4-2935; UNITED KINGDOM: Frank Chambers, 120, Moorgate, London, E.C. 2, Phone Monarch 5661.

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Looking Ahead . . .

. . . **Industry must guard against** a flank attack on the depletion allowance in the new Congress. This warning came last month from Sen. Price Daniel of Texas, who pointed out that the depletion allowance cause may never be entirely won, though victorious battles are fought in each Congress. The implication in Daniel's warning, delivered before Texas independent producers, was that an industry divided on the imports matter must be prepared to unite quickly in the event of a depletion allowance attack.

. . . **Domestic demand will increase** 4 percent or more this year. That is the unofficial prediction of a Bureau of Mines official. Prediction is for a 3 to 3.5 percent gain for gasoline, 2-3 percent for residual fuel oil. Crude and products exports are expected to decline to pre-Korea levels. Forecaster noted that total demand during first nine months was up only about 1 percent over 1953, but upturn in final quarter may push total to about 2 percent.

. . . **$6 billion of oil products** would go into the proposed $100 billion highway development program over the next ten years, Washington sources predict. Clay Committee was expected to send the government's road program to the White House shortly after Christmas. President will outline plans in his State of the Union message to Congress January 6, with detailed recommendations due to reach Congress in February.

. . . **Debate over imports of Canadian gas** may be settled on the basis of supplemental sources. FPC is expected to sanction the plan of Pacific Northwest Pipe Line Corporation and El Paso Natural Gas Company to buy for Pacific markets 300 million cubic feet per day of Canadian gas from Westcoast Transmission Company.

. . . **Proration legislation entering the Wyoming legislature** this month will have the backing of Rocky Mountain Oil & Gas Association. The group is in general agreement with H. B. Gemert of Casper that there "is no desire on the part of the older producing areas to deny this new Wyoming production its place in the market. But other states, notably Texas, do expect this oil to come into the market in an orderly manner."

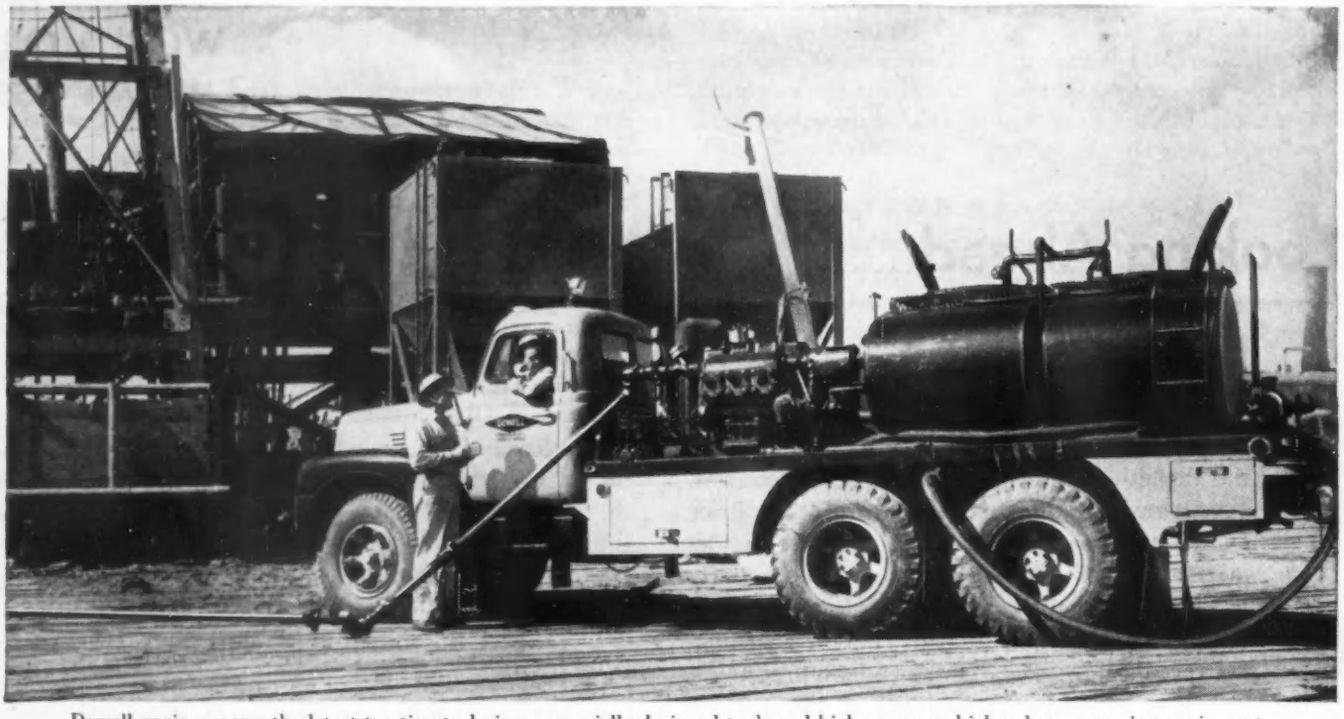
. . . **Federal government expects to save $1 million** annually on its oil and gas bill by whittling its automobile and truck fleet. Vehicles will be reduced from 250,000 to 240,000. The average oil and gasoline charge for each vehicle amounts to about $100 per year.

. . . **Oregon legislators will be asked** this month to increase the present 6-cent state gasoline tax to 8 cents to increase revenues for road work. The 2-cent hike would raise about $11 million.

. . . **A test on the constitutionality** of Colorado's severance tax law, enacted in 1953, is looming. The state has refused to refund $955,238 in taxes paid under protest by The California Company on its 1953 oil and gas production, and company may now appeal to the state revenue director. If he upholds the ruling, the matter may land in court.

. . . **The largest privately-financed radiation laboratory,** where atomic experiments will be conducted in an effort to apply atomic energy to the petroleum industry, will be completed this spring on the east coast.

. . . **Research and development laboratories** of one major oil company have evolved an electronic digital computer believed to be the largest and fastest yet installed by any oil company. One such computer will be put into use in the Southwest within a few months to solve crude exploration and production problems.



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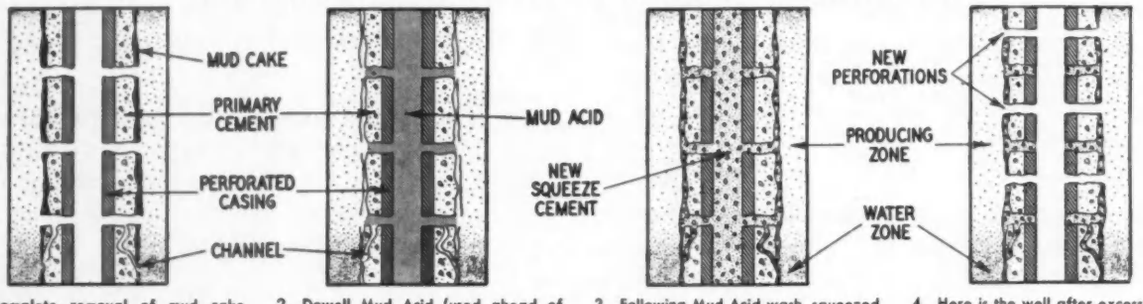

1. Incomplete removal of mud cake produced a poor cement job. This mud may break down, permitting water or gas to enter well.

2. Dowell Mud Acid (used ahead of squeeze job) removed mud cake, cleaned old cement surfaces, exposed clean formation.

3. Following Mud Acid wash, squeezed cement penetrated open spaces . . . formed a good bond with the formation and casing.

4. Here is the well after excess cement had been drilled out and casing re-perforated. In this way, producing zone was isolated.

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Imports Need Calm Study

Increasing oil imports into the United States is a question fraught with the gravest possibilities. It easily could prove the rock on which the domestic oil industry, that of majors and lesser companies alike, could be seriously damaged.

The situation calls for restraint and the use of sound common sense on the part of both sides—for the sake of the interests of both and of the country as a whole. At the same time it does not call for a passive attitude.

Imports—reasonable imports—are necessary. Let there be no mistake about that by the purely domestic producers. They are necessary to provide the ultimate customers of our country with petroleum products at reasonable prices and to allow us to produce our oil with full regard to conservation and the greatest ultimate recovery of our oil.

That such a program has as a by-product a reasonable financial return to the producer of domestic oil is to the interest not only of the domestic producer—among whose ranks we also find the importers of oil, but to the people of the U. S. who are the buyers of petroleum products, and who make the oil industry possible.

For it *is* to the interest of these Americans who buy gasoline, lube, heating oils, etc., to have a sound domestic industry *not* subject to the whims of foreign countries or potentates.

In this connection, we can compliment *most* of the countries from which oil comes to this country—but we have in mind three specific instances where foreign governments decided that they would take over the oil they had contracted to oil companies. The U. S. must have a strong oil industry for economic reasons and for the highly important reason of national defense.

Had the U. S. not had a strong domestic oil industry during World War II, we conceivably might have lost it—and certainly under a poor domestic supply the war would not have terminated as early as it did. Petroleum products constituted two-thirds of the dead weight of munitions, food supplies, etc., moved to the fronts in World War II.

•

In the states which produce most of the U. S. domestic oil, conservation measures and orders have forced the daily allowable production from oil wells down to the point where further reduction will be financially ruinous, many producers will fail and the industry become weak. One does not have to own oil wells or interests in them to see that excessive oil imports will bring this about fairly quickly.

Further, it seems to us that it takes a very short-sighted executive not to realize that increased importations, should they break down the economic structure of the domestic oil producing business, will crack wide open the domestic markets for refined oils of the oil companies, *big* and little. And if any buyer of petroleum products thinks that a major market in these U. S. can be cracked without serious damage to all others, he should have his head examined. We should hate to be the oil company executive or executives responsible for the start of a depression!

Somewhere there must be a point of balance between domestic production and imports which results in a situation desirable to national defense, the consumer, the domestic producer with no oil to import and the importers. We admit that we do not know exactly where that point is—though we believe it can be determined.

But we do believe, and we think that present facts determine that we have not given expression to a paradox that imports have already passed the mutually desirable point—and that the anticipated "inevitable" increase in imports about which we have been hearing, will prove ruinous.

The whole picture requires calm study by all involved. Domestic producers, who do not feel that they should assume in whole or part the burden of a return of Iranian oil to world markets might well ask themselves as to the effect on world oil markets of the dumping of Iranian oil by Russia if it should fall into their hands.

•

States, whose revenues have been hurt by curtailed oil production, should remind themselves that Iran, too, was in desperate straits—and had to regain its oil revenues—and these states might well remind themselves, too, of the ruinous effect of the dumping of the million barrels of oil a day easily available *without additional drilling* in Iran.

But the importers, who have been rightfully concerned about the situation existing in Iran, should remember that from a tax standpoint oil producing states, too, have a vested interest in the oil produced within their borders, and that in addition to independent oil producers, there is a vast army of royalty owners and stockholders of big and little companies who are concerned that the American oil industry continue to be a free enterprise, managed, big and little, by men who can see beyond their noses.

To the independent producers who are rightly exercised by the import situation, we would like to make the reminder that more can be accomplished by reason than by recrimination. A tariff would help, but to ask for something unreasonable will only hurt the cause. Already the public, or much of it, thinks all oil men "fabulously" rich.

Unfortunately leaders of the independents and importers cannot meet and discuss this problem which involves all Americans—and the U. S. of America as well. To do so would be to invite Federal prosecution.

If we have one suggestion to make it is that the state regulatory bodies would do well to put their most earnest, non-political efforts to this question and that they remember that the various aspects of the matter will change from year to year.

Ray L. Dudley

Texas Independents Propose United Front on Imports

Six associations behind program to rally nation-wide support leading to legislative restrictions.

By **AL REESE,** WORLD OIL Staff

INDEPENDENT PRODUCERS of Texas last month discarded a tattered old dream and adopted a new one.

The old: That the imports problem could be settled through "industrial statesmanship."

The new: That it will be settled through the concerted action of U. S. independents, presenting a united front to the nation's lawmakers.

The meeting at Fort Worth had two purposes:

1. To prove that the independents are in belligerent accord for the first time in 25 years—at least in Texas; and

2. To draft a plan so flexible as to meet the demands of all independent groups about the country; and so loftily patriotic, so just and reasonable as to win the sympathy of the politicos and the public.

The unprecedented evidence of unity among the independents was amazing to Gen. Ernest O. Thompson, chairman of the Texas Railroad Commission. "I can remember," he said, "when we used to have independents meet a day in advance so they would have time to shake hands, make up, and present a good appearance at the meeting."

But though there was unity of thought, there wasn't enough unanimity of action to suit some. Said Jack Porter of Houston to the crowd of less than 150: "There's not much of an imports problem, judging from the size of this meeting." Added W. M. Vaughey of Jackson, Miss., president of the Independent Petroleum Association of America: "It's disappointing and puzzling why we don't have more people." He voiced the fear that the small attendance indicated a dangerous lethargy. "If the reason is that it's too close to Christmas, I'd like to warn that if we don't do something about this, there won't be many more Christmases."

But if the army stayed home, at least the generals were there, among them presidents of the sponsoring organizations—IPAA, Texas Independent Producers & Royalty Owners Association, Panhandle Producers and Royalty Owners Association, North Texas Oil & Gas Association, West Central Texas Oil and Gas Association, and East Texas Oil Association —together with numerous other officers of these groups, both past and present, and a sprinkling of public officials. Many were there the day before, working in peace, as Vaughey said, if not always in harmony, on the program for joint action on imports:

. . . . we here resolve that Congress be urged immediately to use its legislative powers to reduce imports to supplemental levels.

"Acting as individuals and through our associations, we now organize ourselves to the end that the Congress will have full information upon which to base corrective action. For this purpose we extend to all concerned with the welfare of the domestic oil industry, including domestic producers of petroleum in every producing state of the nation, an invitation to join in effectuating this program.

"We recommend that a general committee be created from the various associations concerned with the domestic production of oil, such committee to be vested with full authority to make this joint effort effective."

And in conclusion: "Be it therefore resolved that we unite on a program of joint action in support of legislative action necessary to accomplishment of a competitive tariff, tax, or other similar protective measures, the exact character and type of which to be determined by Congress in a manner to serve best our national security and economy."

The program will be put into action by a steering committee, presently composed of the presidents of the six sponsoring organizations, and later to be expanded to include the presidents of all independent producing groups. The steering committee will establish a general committee made up of independents throughout the country. Subcommittees will be named to coordinate all approaches to the problem.

By drafting a program so broad, the planners were offering no fat targets to the barbs of their free-thinking contemporaries in the open meeting; but they were apparently vulnerable to sharp demands for specific proposals for tariffs, taxes or quotas. But the vulnerability was only apparent. Zealous in their new unity, the presidents of the sponsoring organizations shuttled before the microphone with all the agility of a six-man line defending against football's tricky T formation, parrying every thrust with the able aid of the co-chairmen of the meeting, IPAA's W. L. Stewart of Fort Worth and TIPRO's Bryan Paine of Tyler.

"None of us," said Bill Vaughey, "has the wisdom to look down the road and see what form of relief can be acquired in Congress."

"We have been offered almost as many solutions as there are members of these associations," declared TIPRO President Jack Woodard of Dallas. "We have been a long time coming to a program we could all get behind."

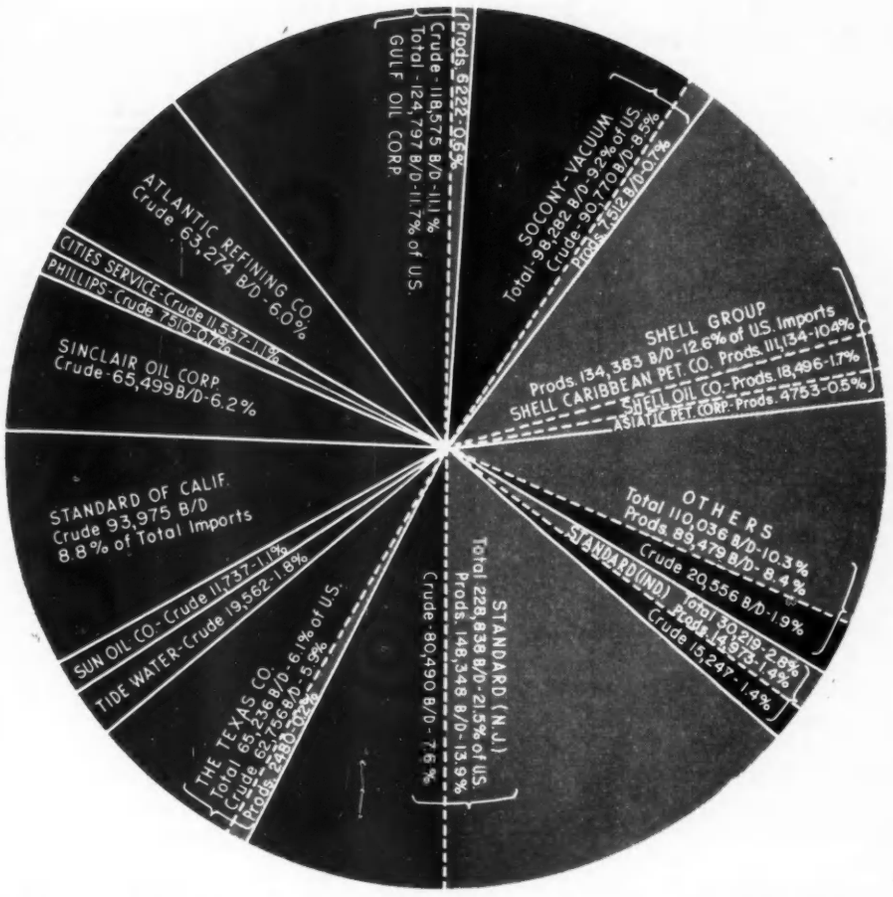
Hefty support also came from the floor:

R. L. Foree of Dallas said it was unimportant what sort of plan to curb imports that Congress eventually adopts. "Just so we get the job done."

Russell Brown, general counsel of IPAA, declared the right start had been made, that out-of-staters would join the movement, "Now that they know Texas independents are coming to them with a solid front."

William Murray, Jr., of the Railroad Commission declared that "this

Continued on Page 70


GULF OIL CORP.
Crude - 118,575 B/D - 11.1 %
Total - 124,797 B/D - 11.7% of U.S.
Prods. 6222 - 0.5%
SOCONY-VACUUM
Total - 98,282 B/D - 9.2% of U.S.
Crude - 90,770 B/D - 8.5%
Prods. 7512 B/D - 0.7%
SHELL GROUP
Prods. 134,383 B/D - 12.6% of U.S. Imports
SHELL CARIBBEAN PET. CO. Prods. 111,134 - 10.4%
SHELL OIL CO. - Prods. 18,496 - 1.7%
ASIATIC PET. CORP. - Prods. 4753 - 0.5%
OTHERS
Total 110,036 B/D - 10.3%
Prods. 89,479 B/D - 8.4%
Crude 20,556 B/D - 1.9%
STANDARD (IND.)
Total 30,219 - 2.8%
Prods. 14,973 - 1.4%
Crude 15,247 - 1.4%
STANDARD (N.J.)
Total 228,838 B/D - 21.5% of U.S.
Prods. 148,348 B/D - 13.9%
Crude - 80,490 B/D - 7.6%
THE TEXAS CO.
Total 65,236 B/D - 6.1% of U.S.
Crude 62,756 B/D - 5.9%
Prods. 2480 - 0.2%
TIDE WATER - Crude 19,562 - 1.8%
SUN OIL CO. - Crude 11,737 - 1.1%
STANDARD OF CALIF.
Crude 93,975 B/D
8.8% of Total Imports
SINCLAIR OIL CORP
Crude - 65,499 B/D - 6.2%
PHILLIPS - Crude 7510 - 0.7%
CITIES SERVICE - Crude 11,537 - 1.1%
ATLANTIC REFINING CO.
Crude 63,274 B/D - 6.0%

U. S. Imports of Crude Oil and Refined Products in 1954 by Companies . . . Barrels Daily Average . . . Total 1,064,885 B/D; Crude 661,488 B/D or 62.1 Percent of Total; Products 403,397 B/D or 37.9 Percent.

Who's Importing Into U. S.?

• A little over a dozen companies bring in about 90 percent of foreign oils.

• Some have increased their imports more sharply and steadily than others.

• For several concerns, imports are equivalent to approximately 30 percent of their refinery runs.

By L. J. LOGAN, WORLD OIL Staff

WHO IS IMPORTING oils into the U. S.? How do the current imports of the different companies compare with their receipts in the past? How do their imports compare with the refinery runs of their domestic plants?

These questions have been raised and are here answered, as imports currently are around the highest levels on record. Independent producers have become increasingly antagonistic toward imports, and there is some apparent criticism of imports even among the importing companies, as some individual concerns defend their own records of imports and hint that other companies are failing to practice equal moderation.

A little over a dozen major companies account for approximately 90 percent of the U. S. imports of crude oil and refined products, and several of those are relatively small importers, leaving only about a dozen concerns as the importers of the bulk of the oils brought in.

Table 1 shows who is and has been importing oils, comparing the current imports of the principal importing companies with their past imports. Presented with benefit of the cooperation of the Independent Petroleum Association of America, the table shows the yearly average imports by each of the companies, by years, for the period 1946 through 1954. It also shows imports for the four quarters of 1954 and the first quarter of 1955. Figures for the 1954 final quarter and the 1955 initial quarter include company estimates as submitted at the November hearing of the Texas Railroad Commission. These figures are subject to possible modification in the light of the new company programs scheduled to be submitted at the December hearing of the commission.

Largest importer, as revealed in Table 1, is Standard Oil Company (New Jersey), which also is the largest U. S. oil company. It imported 228,838 barrels per day of crude and products in 1954, which was 21.5 percent of the total U. S. imports. The 1954 total was less than for 1953, 1952, 1951, or 1950, and only 28.3 percent more than in 1946. The company's imports of crude in 1954 were the lowest of the postwar period except 1950, amounting to 80,490 barrels daily compared with a peak of 105,179 barrels in 1948.

Second largest importing group is the Shell group, including Shell Caribbean Petroleum Company, Shell Oil Company, and Asiatic Petroleum Corporation, which brought in 134,383 barrels a day of products in 1954, representing 12.6 percent of all U. S. imports. Shell's imports were comparatively small in the first few postwar years but in recent years have increased sharply.

Gulf Oil Corporation is third largest importer. In 1954 Gulf brought in 124,797 barrels daily, principally crude, representing 11.7 percent of all U. S. imports. The company im-

TABLE 1—U. S. Petroleum Imports, by Companies, 1946-1955

(All figures in Barrels Daily)

ITEM	1946	1947	1948	1949	1950	1951	1952	1953	% of All Imports 1953	1954[4] 1st Qtr.	1954[4] 2nd Qtr.	1954[4] 3rd Qtr.	1954[4] 4th Qtr.	1954[4] Year	% of All Imports 1954	1955[4] 1st Qtr.
CRUDE OIL																
Asiatic Petroleum Corp.																
Atlantic Refining Co.	11,006	16,753	24,482	38,787	48,609	53,033	54,811	60,363	5.8	58,000	65,000	69,000	61,000	63,274	6.0	61,000
Cities Service Oil Co.	11,732	13,008	18,444	6,768	7,678	7,085	9,473	8,237	0.8	5,000	11,000	11,000	19,000	11,537	1.1	24,000
Gulf Oil Corp.	65,386	68,834	74,244	92,603	106,427	87,434	100,144	108,773	10.4	103,000	122,000	122,000	127,000	118,575	11.1	133,000
Phillips Petroleum Co.					1,769	4,769	9,021	6,561	0.6	6,000	7,000	8,000	9,000	7,510	0.7	9,000
Shell Caribbean Pet. Co.																
Shell Oil Co.			636	10,006	7,915	995										
Sinclair Refining Co.	33,278	28,300	24,595	26,052	45,218	63,997	53,318	66,643	6.4	67,000	63,000	67,000	65,000	65,499	6.2	66,000
Socony-Vacuum Oil Co.	16,000	34,000	55,842	64,450	69,010	68,284	86,421	91,251	8.7	88,000	89,000	92,000	94,000	90,770	8.5	106,000
Standard Oil Co. of Calif.	4,178	7,165	13,778	18,094	31,703	46,283	80,331	108,247	10.3	99,000	93,000	88,000	96,000	93,975	8.8	96,000
Standard Oil Co. (Ind.)	8,128	9,335	10,648	9,586	13,270	12,048	14,257	11,719	1.1	15,000	17,000	15,000	14,000	15,247	1.4	12,000
Standard Oil Co. (N.J.)	85,274	87,192	105,179	90,543	73,994	87,368	98,085	83,728	8.0	82,000	81,000	78,000	81,000	80,490	7.6	79,000
Sun Oil Co.		315	2,549	11,277	7,033	6,793	4,718	11,017	1.0	15,000	10,000	10,000	12,000	11,737	1.1	10,000
The Texas Co.	[1]	[1]	[2]11,946	46,797	64,228	46,225	52,695	68,421	6.5	62,000	62,000	68,000	59,000	62,756	5.9	67,000
Tide Water Assoc. Oil Co.			1,576	620			379	8,767	0.8	12,000	12,000	28,000	26,000	19,562	1.8	29,000
Total Above Co's.	234,982	264,902	343,919	415,583	476,854	484,314	563,653	633,727	60.4	612,000	632,000	656,000	663,000	640,932	60.2	692,000
All Other	815	2,309	8,794	5,475	10,034	6,297	9,000	14,426	1.3	19,000	3,000	31,000	29,000	20,556	1.9	28,000
Total United States	235,797	267,211	352,713	421,058	486,888	490,611	572,653	648,153	61.7	631,000	635,000	687,000	692,000	661,488	62.1	720,000
REFINED PRODUCTS																
Asiatic Petroleum Co.	2,800	4,800	9,000	8,600	9,200	8,100	9,000	7,000	0.7	3,000	7,000	5,000	4,000	4,753	0.5	7,000
Atlantic Refining Co.																
Cities Service Oil Co.				1,519	2,691	1,332	328									
Gulf Oil Corp.	270	7,331	7,302	4,122	3,227	2,911	8,240	13,248	1.2	12,000	5,000	5,000	3,000	6,222	0.6	4,000
Phillips Petroleum Co.																
Shell Caribbean Pet. Co.				28,500	76,300	82,500	96,000	103,500	9.9	149,000	78,000	79,000	139,000	111,134	10.4	155,000
Shell Oil Co.	1,884	12,542	5,253	8,054	7,056	10,837	13,149	13,007	1.1	19,000	19,000	17,000	19,000	18,496	1.7	21,000
Sinclair Refining Co.					607	783	723									
Socony-Vacuum Oil Co.	3,000	5,000	1,690	2,595	3,631	5,170	6,698	7,509	0.7	5,000	8,000	8,000	9,000	7,512	0.7	8,000
Standard Oil Co. of Calif.																
Standard Oil Co. (Ind.)	18,655	13,148	15,056	22,996	35,799	25,881	29,108	22,431	2.2	22,000	11,000	8,000	19,000	14,973	1.4	23,000
Standard Oil Co. (N.J.)	93,084	78,085	79,130	111,356	165,799	164,481	153,008	147,766	14.1	184,000	133,000	102,000	175,000	148,348	13.9	204,000
Sun Oil Co.		335					305									
The Texas Co.	[3]4,000	[3]4,000	[3]5,031	6,832	3,185	4,743	7,515	6,382	0.6	7,000	1,000	1,000	1,000	2,480	0.2	8,000
Tide Water Assoc. Oil Co.																
Total Above Co's.	123,693	125,241	122,462	191,574	307,495	306,783	324,074	320,843	30.6	401,000	262,000	225,000	369,000	313,918	29.5	430,000
All Other	17,704	44,230	38,880	32,735	55,647	47,018	55,478	80,749	7.7	92,000	92,000	89,000	85,000	89,479	8.4	86,000
Total United States	141,397	169,471	161,342	224,309	363,142	353,756	379,552	401,592	38.3	493,000	354,000	314,000	454,000	403,397	37.9	516,000
TOTAL CRUDE AND PRODUCTS																
Asiatic Petroleum Corp.	2,800	4,800	9,000	8,600	9,200	8,100	9,000	7,000	0.7	3,000	7,000	5,000	4,000	4,753	0.5	7,000
Atlantic Refining Co.	11,006	16,753	24,482	38,787	48,609	53,033	54,811	60,363	5.8	58,000	65,000	69,000	61,000	63,274	6.0	61,000
Cities Service Oil Co.	11,732	13,008	18,444	8,287	10,369	8,417	9,801	8,237	0.8	5,000	11,000	11,000	19,000	11,537	1.1	24,000
Gulf Oil Corp.	65,656	76,165	81,546	96,725	109,654	90,345	108,384	122,021	11.6	115,000	127,000	127,000	130,000	124,797	11.7	137,000
Phillips Petroleum Co.					1,769	4,769	9,021	6,561	0.6	6,000	7,000	8,000	9,000	7,510	0.7	9,000
Shell Caribbean Pet. Co.				28,500	76,300	82,500	96,000	103,500	9.9	149,000	78,000	79,000	139,000	111,134	10.4	155,000
Shell Oil Co.	1,884	12,542	5,889	18,060	14,971	11,832	13,149	13,007	1.2	19,000	19,000	17,000	19,000	18,496	1.7	21,000
Sinclair Refining Co.	33,278	28,300	24,595	26,052	45,825	64,780	54,041	66,643	6.4	67,000	63,000	67,000	65,000	65,499	6.2	66,000
Socony-Vacuum Oil Co.	19,000	39,000	57,532	67,045	72,641	73,454	93,119	98,760	9.4	93,000	97,000	100,000	103,000	98,282	9.2	114,000
Standard Oil Co. of Calif.	4,178	7,165	13,778	18,094	31,703	46,283	80,331	108,247	10.3	99,000	93,000	88,000	96,000	93,975	8.8	96,000
Standard Oil Co. (Ind.)	26,783	22,483	25,704	32,582	49,069	37,929	43,365	34,150	3.3	37,000	28,000	23,000	33,000	30,219	2.8	35,000
Standard Oil Co. (N.J.)	178,358	165,277	184,309	201,899	239,793	251,849	251,093	231,494	22.1	266,000	214,000	180,000	256,000	228,838	21.5	283,000
Sun Oil Co.		650	2,549	11,277	7,033	6,793	5,023	11,017	1.0	15,000	10,000	10,000	12,000	11,737	1.1	10,000
The Texas Co.	4,000	4,000	16,977	50,629	67,413	50,968	60,210	74,803	7.1	69,000	63,000	69,000	60,000	65,236	6.1	75,000
Tide Water Assoc. Oil Co.			1,576	620			379	8,767	0.8	12,000	12,000	28,000	26,000	19,562	1.8	29,000
Total Above Co's.	358,675	390,143	466,381	607,157	784,349	791,052	887,727	954,570	91.0	1,013,000	894,000	881,000	1,032,000	954,849	89.7	1,122,000
All Other	18,519	46,539	47,674	38,210	65,681	53,315	64,478	95,175	9.0	111,000	95,000	120,000	114,000	110,036	10.3	114,000
Total United States	377,194	436,682	514,055	645,367	850,030	844,367	952,205	1,049,745	100.0	1,124,000	989,000	1,001,000	1,146,000	1,064,885	100.0	1,236,000

[1] Believed to be negligible in view of small balance shown under "All Other." [2] From data submitted to Select Committee on Small Business, House of Representatives.
[3] Estimated at 1948-50 average. [4] 1954 and 1955 based on data submitted to Texas Railroad Commission; "All Other" estimated based on past history; first three quarters of 1954 are actual; fourth quarter of 1954 and first quarter of 1955 estimates submitted by importing companies at November hearing of Texas Railroad Commission.
Sources: Company reports, unless otherwise specified and except for total U. S. figures which are from U. S. Bureau of Mines.

TABLE 2—Crude Oil Runs to Stills and Imports of Crude Petroleum and Refined Products, by Companies, in 1953

	Crude Oil Runs to Stills (B/D)	IMPORTS Crude Oil (B/D)	IMPORTS Refined Products (B/D)	IMPORTS Total (B/D)	RATIO TO CRUDE RUNS TO STILLS Crude Imports (Percent)	RATIO TO CRUDE RUNS TO STILLS Product Imports (Percent)	RATIO TO CRUDE RUNS TO STILLS Total Imports (Percent)
Asiatic Petroleum Corp.			7,000	7,000			
The Atlantic Refining Company	179,810	60,363		60,363	33.6		33.6
Cities Service Company	226,850[1]	8,237		8,237	3.6		3.6
Gulf Oil Corporation	444,810	108,773	13,248	122,021	24.5	3.0	27.5
Phillips Petroleum Company	229,050	6,561		6,561	2.9		2.9
Shell Caribbean Petroleum Co.			103,500	103,500			
Shell Oil Company	411,980		13,007	13,007		3.2	3.2
Sinclair Refining Company	396,120	66,643		66,643	16.8		16.8
Socony-Vacuum Oil Company	521,050	91,251	7,509	98,760	17.5	1.4	18.9
Standard Oil Co. of Calif.	446,600	108,247		108,247	24.2		24.2
Standard Oil Co. (Indiana)	561,000	11,719	22,431	34,150	2.1	4.0	6.1
Standard Oil Co. (New Jersey)	753,000	83,728	147,766	231,693	11.1	19.6	30.7
Sun Oil Company	222,650	11,017		11,017	5.0		5.0
The Texas Company	543,200	68,421	6,382	74,803	12.6	1.2	13.8
Tide Water Assoc. Oil Company	181,700	8,767		8,767	4.8		4.8
Total Above Companies	5,117,820	633,727	320,843	954,769	12.4	6.3	18.7
All Other	1,881,780	14,426	80,749	94,976	.8	4.3	5.1
Total United States	6,999,600	648,153	401,592	1,049,745	9.3	5.7	15.0

Note: [1] For Cities Service Account only. Also Ran 13,913 B/D for Others.
Source: Crude Runs to Stills from Annual Reports or Moody's Industrials. Imports Based on Data Submitted to Texas Railroad Commission.

ported only 65,656 barrels daily in 1946, but subsequently has increased its imports almost every year.

Socony-Vacuum Oil Company was fourth largest importer in 1954, having brought in 98,282 barrels daily, consisting largely of crude. That company imported only 19,000 barrels a day in 1946 and subsequently steadily increased its takings through 1953 but then reduced them slightly in 1954.

Standard Oil Company of California, bringing in only crude, dropped to fifth place among the importers in 1954 from fourth place in the previous year. The company imported only 4178 barrels daily in 1946 but then increased its imports sharply

Continued on Page 57

Chances Good of Amending Gas Act

But victory—if it comes—will only be after epochal fight. Balance of power in Upper House rests with 41 uncommitted Senators. Outlook in House is vague at the best.

CHANCES ARE GOOD that the new, Democratic-controlled Congress will overturn or modify the Supreme Court's edict that the Federal Power Commission must regulate the price of natural gas from the wellhead.

But victory will come only after an epochal fight.

On the basis of past record, at least 29 holdover or re-elected Senators will vote—with President Eisenhower's tacit backing—to outlaw the decree. In March, 1950, this bi-partisan bloc supported the bill by Sen. Robert S. Kerr (D-Okla.), later vetoed by President Truman, which would have exempted independent producers from federal regulation.

This same bloc heads into the new Congress determined to salvage state control and confident they will achieve some success. Their strategy is being charted warily by sound heads who currently are considering a "one-shot" approach. Under this plan they will withhold any remedial legislation until assured they have enough votes "in pocket" to win.

May compromise. If some form of compromise is necessary, they will accept it. But they hope to restore the status quo—no federal regulation except in interstate commerce—which prevailed before the High Court ruled in the Phillips Petroleum Company case last June.

Opposing this group, also on the basis of the Kerr bill record, will be 26 senators from the Eastern and Midwestern gas-consuming areas. But some of these could defect. A member of the pro-repeal bloc, who wished to remain anonymous, said he had reason to believe some are deeply disturbed by the confusion and chaos caused by the Supreme Court's decision and think the situation should be remedied.

In the final analysis, the balance of power on how the Senate acts will rest with 41 uncommitted senators—holdovers, re-elects, and freshmen—who will be approached early and earnestly by colleagues determined to circumvent the court.

The outlook in the House is vague at best. That chamber passed the Kerr Bill by the scant margin of 176-174. But back in the speaker's saddle will be the same man—Texas' Sam Rayburn—who helped force the Kerr legislation to passage four years ago.

Plans laid. "There certainly will be an effort to pass legislation to improve the present situation," Rayburn told WORLD OIL. He added that he would have no further comment until he had thoroughly digested all developments. But already standing by to introduce a bill is Rep. Oren Harris of Arkansas, second ranking Democrat on the House Commerce Committee which handles such measures. When the Democrats take over the committee will be headed by Rep. J. Percy Priest of Tenn., who is expected to give Harris a sympathetic ear.

Representative Harris said he would predicate his measure on "a survey of what the entire industry wants," plus recommendations made by Eisenhower's National Fuels Resources Committee. Harris also hinted companion bills will be offered by several of his colleagues.

First major obstacle in the Senate could be Sen. Warren G. Magnuson (D-Wash.) who is expected to head the Commerce Committee. Magnuson was paired against on the vote on the Kerr bill in 1950. But next ranking Democrat on the committee is Sen. Lyndon B. Johnson of Texas, the new Senate majority leader whose esteem Magnuson will not want to alienate.

Johnson is in the thick of plans—along with Sen. Kerr—to by-pass the Court's decision. But he is keeping mum publicly. Soon after the court's ruling, he denounced it as "shockingly wrong," and "flying in the face of well-established precedent." He said it was obvious that Congress would have to act "to halt the march toward government regulation."

Also giving support will be Sen. Kerr. But mark it down now that he will not sponsor a bill, as he did in 1950. At that time, he acted at the unanimous request of the Oklahoma Legislature, a fact lost sight of when opponents branded it the "Kerr Bill" and almost defeated it, with the aid of Fair Deal newspaper columnists who linked it with Kerr's oil and gas holdings. Kerr thought, and rightly, that he had been unfairly maligned; he was doing only what the Oklahoma Legislature had urged. But he is now insistent that his name be not identified with future measures. This not only removes grounds for attack but could make the bills more palatable to opponents.

Ike will approve. There is general confidence that Eisenhower will sign a Kerr-like bill. He is dead against federal invasion of state's rights and ordered his National Fuels Resources Committee to look into the Phillips decision and propose corrective legislation. He moved in soon after Sen. Johnson lodged demands for action. But before that the President had signed into law the Hinshaw amendment to the Natural Gas Act, thus providing a clue to his position. This amendment, which he praised, provides that any company which buys natural gas at or within a state boundary is exempted from provisions of the Act if the gas is consumed within that state, and rates, services and facilities are regulated by a state commission.

Basically, the issue posed by the Phillips edict is regional, pitting producers against consuming areas whose congressmen fear the absence of federal regulation will lead to price-gouging. It puts House members from the Southwest at a voting disadvantage because they don't have the numerical strength of their Northern brethren. But they always can resort to the perfectly legitimate practice of log-rolling—trading their support for

Continued on Page 57

ADAMS JENNINGS PETERSEN DONNELL

Industry Leaders See Bright Year Ahead . . .

INDUSTRY LEADERS look back on 1954 as a year of solid achievement contributing to national and international security.

They look ahead to 1955 as a year of bright expectations:

Earnings will stand up.

Crude and gasoline prices likely will remain stable.

Gasoline inventories can be improved.

Proration will be less stringent.

These are the majority opinions of eight presidents or board chairmen who participated in WORLD OIL's annual symposium on prospects for the new year. Those who contributed their opinions are: T. S. Petersen, president, Standard Oil Company of California; James C. Donnell II, president, The Ohio Oil Company; Robert G. Dunlop, president, Sun Oil Company; L. F. McCollum, president, Continental Oil Company; J. S. Leach, chairman, The Texas Company; Reese H. Taylor, president, Union Oil Company of California; K. S. Adams, chairman, Phillips Petroleum Company; and B. Brewster Jennings, president, Socony-Vacuum Oil Company.

But there is a sobering note in their composite predictions. The promised rewards hinge to a degree upon the dissolution of grave problems:

- Government interference must be thwarted through upset of the Phillips ruling in an impending congressional fight.
- Supply and demand must be brought into balance. Some of the executives specifically pointed to the necessity of healing the family rift over imports, though they disagreed as to the remedy.

There were other challenges pointed out in answer to this question:

What are the two most important problems facing the oil industry during the coming year?

Petersen—The freely competitive atmosphere which has existed in the past for petroleum and natural gas is now seriously threatened by federal control on natural gas as a result of the Supreme Court decision in the Phillips case. It is essential to continuance of ample supplies for consumers in the future that this decision be nullified by appropriate legislation by the Congress.

Excess producing and refining capacity, for a national emergency, attained at federal government request by the industry at the latter's own expense, constitutes a sizable problem if we are to avoid periods of uneconomic production of crude oil and products.

Donnell—The industry's primary task during 1955 is to obtain an amendment to the Natural Gas Act in order to restore the freedom which is needed for insuring an adequate and continuous supply of oil and gas. Federal regulation of natural gas sales at the wellhead can't help but lead to conflict and confusion between and among the Federal Power Commission, the various producing states, and the thousands of units in the industry. While its net tangible result will be an adverse effect on the supply of natural gas, the moral issue is much more compelling as a force for uniting oil and gas producers in demanding release from federal control. In the forthcoming struggle, producers should be strengthened by the knowledge that they are fighting for the

DUNLOP McCOLLUM LEACH TAYLOR

IF

Supreme Court ruling in Phillips case is overturned by Congress . . .

AND IF

Supply and demand can be brought more nearly into healthy balance . . .

preservation of the fundamental principles which have made our nation great.

Dunlop—The two most important problems facing the industry during the coming year are: (a) limitations upon economic freedom by government, and (b) restoration of petroleum supply and demand equilibrium.

(a) Encroachments upon economic freedom have taken place in the area of price making (regulation of prices for natural gas sold by independent producers in interstate commerce for resale, and price inequities resulting from the operation of toll road authorities); and in the area of marketing structure (divorcement proceedings against integrated oil companies, and exclusive dealing litigation).

These inroads into competitive freedom have, in effect, denied two basic economic truths: first, that the lowest possible price to the consumer consistent with the best employment of productive resources can result only from the action of many individual units in a freely competitive system; and second, that the most effective and lowest cost distributive system is the one that evolves when competitors strive for maximum efficiency in a free market.

(b) During the past several years, in the interest of national defense, the industry has built more producing and refining capacity than would have been called forth by normal economic demand, thus raising the problem of excess capacity. So long as international tensions makes this necessary, a major problem will be one of adjusting the supply rates (within the framework of excess capacity) to the more moderate increases in demand that are anticipated.

McCollum—The two most important problems facing the oil industry during the coming year are:

A. The issue of federal control over the production of natural gas. This matter is of vital concern not only to the industry but to all the natural gas consumers in the country, because the finding and developing of the future supplies of gas are threatened.

B. The attainment of a proper balance between supply and demand. This problem is being aggravated by the rapid increase of foreign production which reduces export of petroleum products from the U. S. and causes extra pressure for the importation of crude oil and products into the U. S. The immediate solution of this problem appears extremely difficult.

Leach—In reviewing the outlook for next year, we believe that there are three paramount problems facing the industry, all equally important:

1. Depletion allowance. The continuing effort to reduce or eliminate the percentage depletion allowance threatens the ability of the industry to continue its exploration and drilling activity. If the depletion allowance were materially reduced or eliminated, it would result—very shortly—in higher prices for petroleum products, lower demands, and, more important, lower reserves. The industry's inability to continue building its reserves would jeopardize the defense and prosperity of the nation.

2. Natural gas. The Supreme Court decision in the Phillips Petroleum case results in a new source of government interference with the oil and gas industry. The new ruling—which empowers the FPC to apply the rigid public-utility type provisions of the

Natural Gas Act to production, processing and gathering of natural gas which ultimately moves in interstate commerce—constitutes a direct threat to the development of the nation's gas reserves. We think this regulation unwise for several reasons:

- It impairs established contractual rights.
- It discourages further investment in gas development.
- It conflicts with state conservation rulings and orders.
- It results in federal control of oil production.
- It applies public utility concepts to a competitive and speculative business.

We believe that the Natural Gas Act should be amended to except from its provisions the business of producing, gathering and processing natural gas and the resulting sales to those who transport it in interstate commerce.

3. Imports. The threat of additional restrictions against U. S. imports of petroleum constitutes a menace to the national security, the petroleum industry, and petroleum consumers.

Nearly all foreign crude oil being brought into the U. S. is imported by firms with interests primarily in the domestic industry. The individual business decisions that, in the aggregate, determine the actual level of imports are, in consequence, made in full light of existing domestic requirements and domestic production trends. The record shows that these individual decisions by members of the industry have, in fact, been consistent with strong vitality and growth in the domestic producing industry which, over the years, has established an outstanding record as a "growth industry." This approach has made a vital contribution to America's economic welfare and security by enabling the industry to make flexible adjustment to long-run trends in America's petroleum requirements and to meet crucial emergency needs for petroleum.

It is clear that any legislative restriction, whether tariff, quota, or some hybrid scheme, would tend to rigidify the level of imports and to eliminate the required flexibility.

Taylor—In our opinion, the two most important problem areas at the present time are related to the imbalance between supply and demand and to the trend toward federal government control of private industry.

Due largely to a general economic readjustment, demand for petroleum products during 1954 has not achieved expected levels. Simultaneously, large imports of low-cost foreign crude oil and the excess refinery capacity built as standby facilities against a possible national emergency have resulted in over-supply. Consequently, inventories became burdensome during 1954. Although progress has been made in solving this problem, it will continue to merit close attention by the industry.

During 1954, the U. S. Supreme Court decided in the Phillips case that the Federal Power Commission had authority to regulate the wellhead price of any natural gas that goes ultimately into an interstate transmission line. Subsequently, the commission has issued an order freezing prices for such natural gas in complete disregard of competitively negotiated contracts between buyers and sellers. Unless this intolerable situation is rectified by legislation, it will seriously retard exploration for and development of natural gas reserves for interstate shipment. This will lead ultimately to inadequate gas supplies, and the previously rapid expansion of interstate natural gas transmission lines to meet customers' needs may not continue. The Phillips decision is but one facet of a trend toward governmental intervention in private industry.

Other important evidences of this trend include the suits instigated by the Department of Justice to divorce integral activities from integrated petroleum companies and the proposals related to "end-use control" of fuel resources. Together these pose a real problem to industry in general and the petroleum industry in particular. The consumer is also threatened, in that success of such attacks on free enterprise would inevitably result in reduced efficiency and higher petroleum product prices.

Adams—The two most vital problems facing the petroleum industry in the year ahead pose serious dangers to future supplies of the industry's two basic resources—natural gas and crude oil.

To one of these problems, regulation of independent producers of natural gas, there is a clearly marked solution. This is for Congress to enact legislation which will undo the Supreme Court's decision of last June in language which clearly exempts independent gas producers from federal regulation.

The alternative is continued regulation which adversely affects every segment of the petroleum industry as well as gas consumers. This is the direct route to reduced gas supplies and higher consumer prices in non-producing states, curtailment of exploration and development for new reserves, and gradual but certain destruction of the balancing effect of the law of supply and demand as it relates to gas and other competing fuels.

So long as it operates in the shadow of natural gas regulation, the petroleum industry, along with other competitive industries as well, is under perhaps an even greater threat. That threat, if not removed, may lead eventually to federal regulation not only of the entire oil industry but of other competitive, producing industries, such as coal and other minerals, agriculture, and lumbering.

While the solution is clearly marked, no one in the industry can afford to be complacent about the chances of reaching it. Whether the effects of regulation are broadened and lengthened, or whether they are removed, will be determined by the extent to which our industry, other competitive industries, gas transmission and distribution companies, gas consumers, municipal officials, and all others vitally affected by the Supreme Court's decision, encourage congressional legislation to free gas producers from federal regulation. It is a tremendous public information job which requires all-out effort by all concerned to insure the support required for the necessary congressional action.

With respect to crude oil imports, a year ago I said that the real problem posed by continued excessive importation of foreign crude oil was to determine and adjust to import levels that would not discourage domestic discovery and development activities.

In the meantime, this problem has come no nearer to solution, and domestic producers have been badly hurt by greatly reduced allowable production rates as foreign crude has supplanted domestic crude to an alarming extent. Total U. S. crude oil supply during 1954 was 2 percent below the level of 1953, and the relationship of supply to demand has improved in recent months. However, imports, which

were already excessive in 1953, were not reduced. Thus the domestic producers bore the entire brunt of the reduction of supply with a 160,000 barrels per day cut in production.

Some major importers have reduced their volumes of imports, but the overall reduction has not gone far enough to keep the domestic producing industry from facing curtailed exploration and development activity. In Oklahoma, for example, an official state employment agency report showed over 2000 fewer people employed in petroleum production work in September, 1954, than in the same month of the previous year.

It seems plain that something must be done. Thus far, voluntary action by importing companies has failed to accomplish the needed reduction of imports. Whether the problem can be solved without some form of restriction, such as import quotas or tariffs, remains to be seen. It must be solved, not only for economic but also for national security reasons. The nation cannot risk a major defense emergency with foreign supplies cut off and with the domestic industry too weakened and too far behind in developed production to provide promptly the crucial petroleum products essential to survival.

Jennings—Although demand for petroleum products in the U. S., including exports, is expected to increase about 3.5 percent next year to the highest level in history, the oil industry's ability to supply these products will continue to exceed demand.

Capital expenditures for oil exploration, production, transportation, refining and marketing totaled some $4 billion in 1954; they probably will approximate that figure in 1955. Since the industry currently has an excess of some 15 percent in refining capacity and probably something more in crude oil producibility, why the need for such an outlay?

The answer is twofold:

- A good deal of the money oil companies are investing in properties, plants and equipment is being spent to meet stiffening quality competition in a buyer's market created by the industry's vast postwar increase in output. Many of the new refining units are being built not to process more oil, but to make better products.
- In any industry as vital and dynamic as petroleum, companies must act in response to future as well as present considerations. Money must be spent now to provide equipment and sources of supply we expect to need several years hence. The producing end of the business demands the longest look down the road. To develop crude oil production in a virgin area, for example, normally takes 10 to 15 years.

It is essential that the industry continue to develop oil reserves and facilities, whatever the future may hold. Barring a major conflict between Russia and the West, which there is some reason to believe will not occur in the next several years, each side will work to consolidate its position by improving and strengthening the economy of its orbit. The further development of inexpensive mechanical energy, which depends largely on the availability and use of oil, will be a key factor in these efforts. Because we and many other nations recognize a common interest in satisfying the material needs of all men throughout the free world, we are likely to see in the next decade economic development on a scale surpassing anything the world has ever known.

A cause for deep concern to the U. S. oil industry is the Supreme Court's recent split decision which asserts the authority of the Federal Power Commission to regulate the price paid to producers who sell natural gas to interstate transmission lines.

Quite aside from the effect price regulation may have on natural gas supply and distribution, and thus on consumers, the most serious question involved is one of principle. If gas can be regulated by virtue of its use in a public utility, why not everything a utility uses, whether fuel oil or coal, automotive vehicles, business machines or what-have-you? From a long-range standpoint, it is a question that could affect many businesses. It strikes at the very roots of our free economy.

The Supreme Court's decision is an interpretation of the Natural Gas Act, a law passed by Congress. Congress has the power to change the law, and there is every indication that legislation seeking relief from the Court's ruling will be introduced in the next session.

Will industry earnings stand up?

Petersen—I believe that the industry's earnings will stand up well in 1955.

Donnell—Earnings in 1955 should compare favorably with those of 1954. This conclusion is predicted mainly on an increase in crude oil production and refinery runs to stills resulting from an anticipated demand increase of about 4 percent. Of course, any increase in imports would limit the increase in crude oil production.

Dunlop—On balance, 1955 earnings should be not less than those of 1954.

McCollum—Earnings of the industry in 1955 should be at approximately the same levels as those in 1954.

Leach—The outlook for the industry leads one to expect that earnings in 1955 will be somewhat lower than in 1954 due to rising costs and severe competition.

Taylor—Unless serious unexpected weakness in the U. S. economy should develop, we believe that earnings in the petroleum industry next year should be at least comparable to those of 1953 and 1954. The federal tax relief measures of the past year should compensate partially for the less favorable aspect of reduced profit margins.

Will crude oil and gasoline prices remain stable?

Petersen—I would anticipate that they will.

Dunlop—The physical volume of sales in 1955 should be higher than in 1954. The outlook for 1955, however, is for another year of keen competition within the industry, with consequent effects upon product prices.

McCollum—It is difficult to envision any increase in crude oil prices in view of the forecast increases in rates of imports of foreign oil, even though the costs of finding and developing domestic supplies continue to increase.

Gasoline prices are expected to fluctuate seasonally, but should average out about the same as the last half of 1954 or perhaps a little higher.

Leach—I believe basic crude oil prices will remain fairly stable. Gasoline prices will be largely determined by the level of refining operations and the yield pattern over the next several months. If refinery runs are at a relatively high level over the next few months, and no significant shift is made in the yield pattern, we can expect gasoline price wars to spread in the late winter and early spring, but no major break in gasoline prices is anticipated.

Taylor—Demand is expected to resume its long term uptrend during

1955. Consequently, it is expected that crude oil and gasoline prices will remain stable.

Will the U. S. gasoline inventories be in balance next spring?

Petersen—Judging from the fact that U. S. stocks are now only about 5 million barrels higher than a year ago, as compared with 20 million or more last summer, I would anticipate that there is a good chance of these not being excessive next spring. However, this is predicated on no overproduction this winter, which could occur if a cold winter should stimulate refinery runs for heating oils.

Donnell—Whether or not the necessary balance in gasoline inventories will be gained by next spring depends on weather conditions. I feel, however, that there is a good chance the balance will be attained and that the price structure will not be markedly different than at present.

Dunlop—Some improvement in the gasoline inventory situation has taken place. The degree to which this trend continues into spring will depend upon how far refiners are able and willing to adjust refinery throughput and product yields as the winter season progresses.

McCollum—Gasoline stocks, which were too high at the end of the driving season in the fall of 1953, were pyramided during the winter, so that they have been well above desirable levels all during the current year. Despite the fact that stocks (as of the end of November) are approaching the levels of a year ago, they continue to be too high in view of current and anticipated demand. Stocks can be brought back into balance by the end of next summer, or perhaps earlier, if each refiner will appraise his stocks in relation to realistic sales forecasts and govern his refinery operations accordingly. This will necessitate self-imposed restraints both as to crude runs and gasoline yields.

Leach—Gasoline inventories will still be relatively high next spring, probably reaching 190 million barrels by the end of March. However, increased demand will tend to reduce the downward pressure on prices.

Taylor—It is expected that inventories will achieve a more economic balance with demand during 1955.

Will more stringent proration be necessary?

Petersen—The stringent proration in 1954 was largely necessitated by two conditions which caused demands to be materially lower than under normal conditions, namely a mild economic recession and abnormally warm weather conditions. I believe that proration will be considerably less stringent in 1955, providing that we are blessed with continued improvement in economic conditions and weather which is normal or colder than normal.

Donnell—I feel that the burdens of proration should be more equitably distributed among the various oil-producing states. Not only would this enhance the stability of the industry, it would also contribute to national defense by providing excess productive capacity on a wider geographic basis.

Dunlop—In view of the expected moderate increase in demand for products, it is expected that less stringent proration of domestic crude oil will be necessary.

McCollum—In view of the levels of crude stocks and the moderate increase in demand forecast for 1955, more stringent proration should not be necessary; on the other hand, sizable increases in allowables are also unlikely. Some of the states that are not now prorating to market demand should do so to protect the rights of the producers and royalty owners in the various fields within those states, and to prevent production in excess of requirements, particularly of certain grades of crude oil.

Leach—It must be remembered that part of the stringent restrictions during 1954 resulted from the overproduction in the early part of the year and in 1953. While crude stocks have been reduced, they are still high, but considering the probable increase in demand during 1955, there should be some easing in proration allowables.

Taylor—Excessive crude oil imports could, of course, destroy completely the prospective inventory balance and price stability, necessitating more stringent proration. For this reason we have consistently stressed the importance of and our dependence upon a healthy domestic industry.

What may be considered the greatest industry accomplishment of 1954?

Petersen—I believe that the promulgation and approval of the Iranian Agreement is probably the most outstanding accomplishment.

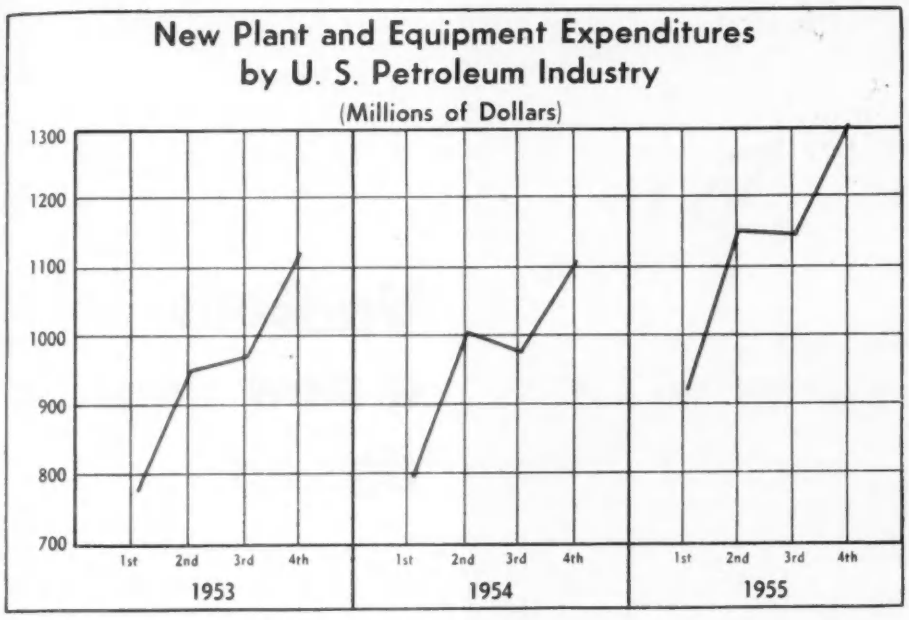
Donnell—During 1954 the industry managed to bring supply more nearly into balance with demand, an accomplishment which is noteworthy as we enter a new year.

Dunlop—It is difficult to single out any one development as the greatest industry accomplishment of 1954. Unquestionably, however, included in any listing of the industry's accomplishments would be the substantial increase in the quality of motor gasoline which has been made available to the American motoring public during the year drawing to a close. The motor fuels available to the consuming public in 1954 reached undeniably high standards of quality and have been available to the public at the competitive price levels which have been characteristic of the petroleum industry.

McCollum—The greatest industry accomplishment in 1954 was the continuation of a drilling rate such that the U. S. now has a reserve productive capacity approaching 2 million barrels per day; this provides the American public with a large degree of security, as it exceeds current import rates by about 1 million barrels daily.

Leach—In my opinion, the settlement of the Iranian dispute was one of the greatest industry accomplishments in 1954. As the agreement is written, it is fair to the Iranian government and to the petroleum industry. We confidently expect that the Iranian solution will ease the tension in the Middle East and will be a strong contribution to international peace.

Taylor—Probably the outstanding achievement of the petroleum industry during 1954 has been its demonstration of the flexibility of the private enterprise system. During a period of slackening product demand and rising inventories, the industry has been able to expand its production and refining facilities to meet the requirements of a possible national defense emergency without impairment of its financial position and without the assistance of the federal government. Of course, there is a limit to the industry's ability to absorb the financial impact of a permanent over-capacity. If this situation is to continue indefinitely, ways must be found for the industry to earn a return on its defense-inspired capacity investments. —**The End**



Federal report indicates . . .

Oil Industry Plant and Equipment Outlay to Soar

By **DON KLIEWER and CECIL W. SMITH,** WORLD OIL Staff

The high rate of petroleum industry expenditures for new plants and equipment, estimated at $3,811 million for 1954, is expected to reach a record level this year. This view is indicated by analysis of the report recently released by the Commerce Department's Office of Business Economics and based on a survey conducted last November by the Commerce Department and Securities and Exchange Commission.

Also, Frank M. Porter, president of American Petroleum Institute, has expressed belief that capital expenditures for the oil industry in 1954 were of record-breaking proportions, despite a decline in many operations. An API forecast earlier indicated that capital expenditures, including foreign operations, would exceed $4,600 million in 1954. Porter pointed particularly to the record-breaking levels of drilling activity and increased refinery capacity, both of which require large sums of money.

While in the OBE report, the oil industry expenditures were reported along with those of the coal industry, the total covers only the oil industry for all practical purposes since coal's share is nominally very small.

As the only major non-durable goods industry to indicate a rise in the rate of capital outlays from the first quarter of 1954 to the initial quarter of this year, as indicated in the report, oil's expected expenditures covering the January-March period this year were put at $900 million by OBE. That is tantamount to a significant increase from the same period the previous year of $128 million, or 16.6 percent.

The initial quarter of 1954 was credited with expenditures of $772 million, $7 million greater than the total outlay in the first quarter of 1953.

If the investment trend indicated by the 1953 and 1954 Commerce Department reports is continued (see chart), petroleum industry outlays this year will approximate the following totals, by quarters: $900 million (as estimated by Commerce Department); $1,130 million, second quarter $1,128 million, third quarter; and $1,287 million, fourth quarter.

Thus, total expenditures for the industry this year may approximate $4,444 million—16.6 percent more than the 1954 total of $3,811 million.

These estimates for the second, third and fourth quarters of 1955 are based, of course, on a continuing rate of investment approximating that which has been reported by the department for the past two years.

While the report does not deal individually with petroleum expenditures, all petroleum operations, except some independent wildcatting, are included under the department's "Petroleum and Coal Products" classification. At least 99 percent of the figures in the report refer to the oil industry.

The government report considers petroleum as covering wells, equipment, natural gasoline, cycling, refining plants, and everything else pertaining to the industry.

Wildcatting and some other independent operations are included under the report's "Mining" classification, but only a scant part of this total, something less than 1 percent, involves non-oil operations.

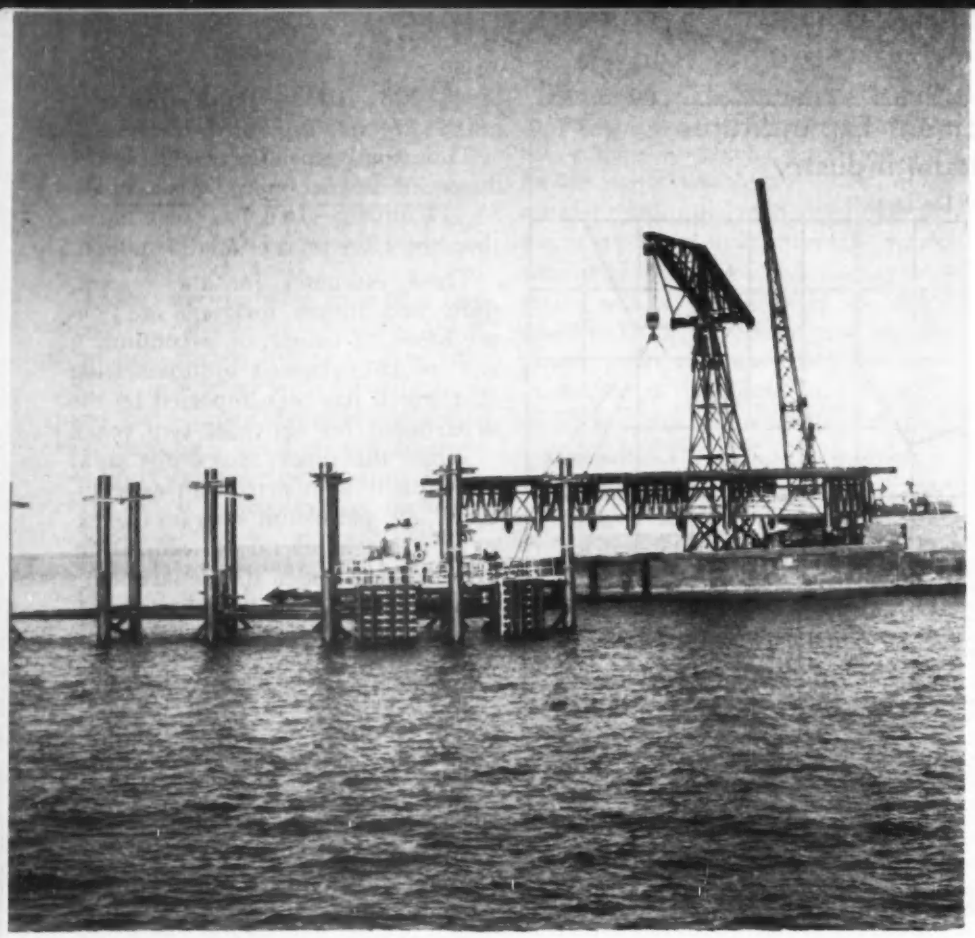
The accompanying chart, however, does not include expenditures for oil and gas pipe lines.

Thus, the expenditures on new plant and equipment by the domestic petroleum producing and processing industry estimated here indicate an optimistic outlook.

The "Petroleum and Coal Products" and "Mining" figures, estimated by the government and described as covering oil operations almost to the point of excluding non-oil operations, indicate:

- That 1955's second quarter expenditures will approximate $1,130 million, $230 million greater than the preceding quarter and 14.6 percent more than the second quarter of 1954.
- That 1955's third quarter, dipping slightly as in the previous year, will drop to $1,127 million, but remaining 17.0 percent higher than the third quarter of 1954.
- That 1955's final quarter will jump to an estimated $1,287 million, $197 million more than the fourth quarter of 1954 and 14.2 percent above the third quarter of 1955.

—**The End**

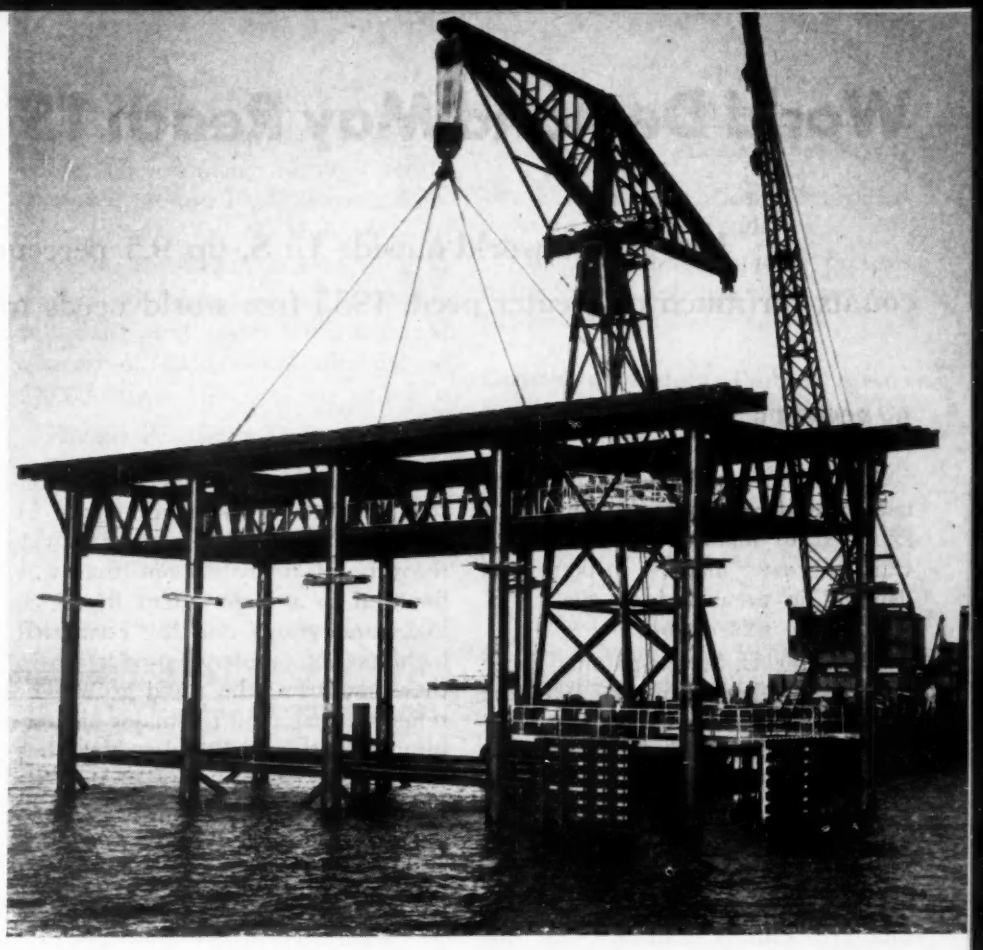


Up Goes a new rig . . .

1 Derrick barge begins its step-by-step task (above) of lifting the 230-ton deck section of the new offshore drilling installation of Western Natural Gas Co. toward the platform, in water 43 feet deep, for which it was designed.

2 At right the deck section is moved over almost in place. Note pointed guides which will slip into the hollow pilings, where they will be welded. The well site is five miles off Matagorda Island, due south of Palacios, Texas.

. . . for a look below the sea



3 Now, the section, prefabricated along with the template at Brown & Root, Inc., marine yards at Green's Bayou, Texas, is securely in place (above). Wooden scaffolds are left on the piling for the welders' use.

4 This is the completed platform (left) after derrick and all equipment have been put in place. This self-contained platform has storage and crew quarters on lower deck. The template weighs 170 tons, through which were driven ten 30-inch pilings 100 feet into the floor of the Gulf of Mexico.

World Demand May Reach 15 Million Barrels

Use in free world outside U. S. up 9.5 percent. Busy Western Europe accounts for much of greater need. 1955 free world needs to be up 6.6 percent.

By ROBERT E. SPANN, World Oil Staff

An anticipated high level of industrial activity in Western Europe is expected to maintain the trend toward a greater increase in petroleum demand in areas outside the U. S. than inside this nation.

While the U. S. was gaining about 1 percent in demand during 1954, the growth in other parts of the free world was about 9.5 percent. Based on preliminary figures, the volume of demand for all oils reached a new high in 1954, averaging about 5,360,000 barrels daily.

Current estimates for 1955 from qualified sources indicate that the free world outside the U. S. can expect a further expansion in demand of about 8 percent, or perhaps slightly higher. This would boost total demand in those countries to an average of about 5,825,000 barrels per day. By comparison, estimates of domestic demand, exclusive of exports, in the U. S. for all of 1955 range from a gain of 3.1 percent to nearly 6 percent over 1954, with the average at approximately 4.5 percent.

Adding the anticipated 1955 foreign demand to that expected in the U. S., total petroleum demand in the free world in 1955 is expected to reach an average of 13,991,000 barrels daily, or an increase of about 6.6 percent over 1954. Including a strictly estimated demand of 1,200,000 barrels daily in the U.S.S.R. for 1955, the world total oil requirement for the year will reach 15,191,000 barrels daily, up 6.8 percent over 1954.

The estimated 8 percent expansion in free world demand outside the U. S. for 1955 is believed to be conservative, and may be revised upward by mid-year.

The factors contributing to the unusually high rate of growth in demand abroad generally are the increasing availability of petroleum as a source of energy in nations that had been almost solely dependent upon coal for their fuel requirements in the prewar years; the rapid postwar recovery of many nations that was financed to a large extent by U. S. loans and grants and the continued high level of industrial production in these countries; the rapid growth of refinery capacity in the major oil consuming nations abroad which has lowered the costs of petroleum products and created a new industry in many of these countries; and the intensified competition among international oil companies to supply these foreign markets.

The continued large expansions in demand in Western European nations has been the pace setter in the growing foreign market. In the first nine months of 1954 European demand—exclusive of Russia and the Iron Curtain countries—increased 14 percent over the like 1953 period. For all of 1954 Western Europe was expected to record a 12 percent gain over 1953. Estimates for 1955 place the gain in European demand for all oils at 10 to 11 percent over 1954.

This contradicts many predictions of a year ago that the expansion in petroleum demand in Europe was leveling off after the post war rebuilding boom in the United Kingdom and on the Continent brought gains in demand of 17.5 percent in 1950 and 16.5 percent in 1951. The annual increases declined to more modest margins of 8.9 and 8.2 percent, respectively, in 1952 and 1953, but a new upturn started in 1954.

In other major consuming areas, it is expected that the growth in petroleum demand in South America in 1955 will amount to about 8 percent over 1954, or approximately the same gain as recorded in 1954. This would boost total South American demand to about 978,000 barrels daily, compared with 838,900 barrels in 1953. Large gains in demand in Argentina and Brazil have been the most important factors in raising petroleum use in South America.

Africa and the Middle East recorded a demand increase of 7 percent in 1954 and a gain of a like amount is expected in 1955. In Asia and the Far East (includnig Oceania) a gain of about 9 percent was experienced in 1954. The estimate for 1955 is for an expansion of about 8 percent.

The encouraging outlook for demand in foreign areas is tempered somewhat by oversupply. stimulated primarily by the flush fields of the Middle East. Petroleum has experienced an oversupply in all of the postwar years since 1947. In 1953, the last year for which complete figures are available, the world-wide margin of new supply over demand amounted to an average of 311,100 barrels daily.

It is probable the excess of new supply over demand in all of 1954 possibly surpassed the peak level of 456,000 barrels daily reached in 1948. It is difficult this early to predict the 1955 trend of new supply in foreign areas with any degree of accuracy, but there is ample oil available in all the major producing areas—the Middle East, Venezuela, Canada and Indonesia—to meet any probable level of demand with a comfortable margin of safety.

Such a situation, plus keener competition and the return of Iranian production to international trade, has prompted many observers to predict a greater degree of price shading than was experienced in 1954. In the past year, price shading has been limited to refined products and with the Abadan refinery on stream even at half-capacity levels, there are indications that price shading will be extended—particularly for residual fuel oil. This trend could easily be extended to crude should the refiners' margins be greatly depressed.

Who's Importing Into U. S.?

Continued from Page 42

each year until they reached 108,247 barrels daily in 1953, after which they came back down to 93,975 daily in 1954.

Sixth in imports in 1954, by a slight margin, was Sinclair Refining Company, which brought in 65,499 barrels per day, all crude, a slight decrease from 1953. Sinclair has been consistently a substantial importer, with receipts as high as 33,278 barrels daily in 1946.

The Texas Company in 1954 was seventh largest importer, after having been sixth in the previous year, ahead of Sinclair. Texas Company imports of 65,236 barrels daily in 1954, largely crude, compared with 74,803 daily in 1953. Texas steadily increased its receipts from 4000 barrels a day in 1946 and 1947 to the 1953 peak and then cut them back in 1954.

Atlantic Refining Company in 1954 was eighth largest importer, ranking only slightly below Sinclair and Texas. Its receipts of 63,274 barrels daily, all crude, compared with 60,363 daily in 1953. Atlantic has steadily increased its imports from 11,006 barrels daily in 1946.

Standard Oil Company (Indiana) is ninth largest importer, having brought in 30,219 barrels daily in 1954, about one-half crude and one-half products. That was the smallest total for the company since the early postwar years, 1946-1948, when receipts were around 25,000 barrels daily. In 1949 and 1950 Indiana increased its imports sharply to the peak of 49,069 daily in 1950, but since then it has been reducing them.

Tide Water Associated Oil Company in 1954 became tenth largest importer, having brought in 19,562 barrels daily average of crude oil, a sharp increase from the 8767 daily of 1953. Its schedules covering current months have called for imports between 25,000 and 30,000 barrels daily. The company imported very little prior to 1953.

Sun Oil Company ranked eleventh in imports in 1954, with receipts of 11,737 barrels per day of crude, a slight increase over 1953. Sun brought in similar or smaller volumes in other postwar years after importing none in 1946 and only small amounts in 1947 and 1948.

Cities Service Oil Company was twelfth in imports in 1954, with receipts of 11,537 barrels per day of crude. The company has consistently imported around 10,000 barrels daily since World War II. However, imports for the fourth quarter of 1954 were scheduled to average 19,000 barrels daily and those for the initial quarter of 1955 were estimated at 24,000 daily.

Phillips Petroleum Company made no imports in the first several postwar years, started importing crude in 1950, brought in a peak of 9021 barrels of crude daily in 1952, cut receipts to 6561 daily in 1953, raised them to 7510 daily in 1954, and currently is bringing in about 9000 daily.

Imports/Refinery Runs Ratio. Table 2, also presented with the aid of the IPAA, shows the ratio of imports to refinery runs, by principal companies, for the year 1953, latest period for which data are available. The information on runs to stills was obtained from the annual reports of the companies.

For the U. S. as a whole, total imports in 1953 were equivalent to 15.0 percent of refinery runs. For the major importing companies, total imports were equivalent to 18.7 percent of their refinery runs. For all other companies, total imports were equivalent to 5.1 percent of refinery runs.

The total imports of several concerns are equivalent to around 30 percent of the refinery runs of their domestic refineries; the ratios including 33.6 percent for Atlantic Refining Company, 30.7 percent for Standard Oil Company (New Jersey), 30.0 percent for the Shell group of companies, 27.5 percent for Gulf Oil Corporation, 24.2 percent for Standard Oil Company of California. For Socony-Vacuum Oil Company, total imports in 1953 were equivalent to 18.9 percent of refinery runs, and similar ratios included 16.8 percent for Sinclair Refining Company, 13.8 percent for The Texas Company, 6.1 percent for Standard Oil Company (Indiana), 5.0 percent for Sun Oil Company, 4.8 percent for Tide Water Associated Oil Company, 3.6 percent for Cities Service Company, 2.9 percent for Phillips Petroleum Company. —**The End**

Congress and Gas Act

Continued from Page 43

pet Eastern and Midwestern measures—to attain their ends.

No such voting disparity prevails in the Senate, although there, too, log-rolling is traditional.

Opposing leaders. Probably spearheading the Senate fight to uphold the Phillips decree will be Sens. Estes Kefauver (D-Tenn.), Willian Langer (R-N.D.), Paul Douglas (D-Ill.), Hubert Humphrey (D-Minn.), Herbert H. Lehman (D-N.Y.), and Wayne Morse (Ind.-Ore.).

The Kerr Bill passed the Senate 44-38 on March 29, 1950. Here are the senators—who will be around for the new Congress—who voted for it:

Johnson (D-Tex.), Anderson (D-N.M.), Bricker (R-O.), Bridges (R-N.H.), Byrd (D-Va.), Capehart (R-Ind.), Eastland (D-Miss.), Ellender (D-La.), Frear (D-Del.), Fulbright (D-Ark.), Hayden (D-Ariz.), Hickenlooper (R-Ia.), Holland (D-Fla.), Johnston (D-S.C.), Kerr (D-Okla.), Long (D-La.), McCarthy (R-Wis.), McClellan (D-Ark.), Martin (R-Pa.), Millikin (R-Colo.), Robertson (D-Va.), Russell (D-Ga.), Schoeppel (R-Kan.), Sparkman (D-Ala.), Stennis (D-Miss.), Watkins (R-Utah), and Young (R-N.D.). Sens. George (D-Ga.), and Malone (R-Nev.) were paired for it, making a total of 29—18 Democrats and 11 Republicans.

Here are the senators—also to be around—who voted against it:

Senate GOP Leader Knowland (Calif.), Aiken (R-Vt.), Chavez (D-N.M.), Douglas (D-Ill.), Dworshak (R-Idaho), Flanders (R-Vt.), Green (D-R.I.), Humphrey (D-Minn.), Ives (R-N.Y.), Jenner (R-Ind.), Kefauver (D-Tenn.), Kilgore (D-W.Va.), Langer (R-N.D.), Lehman (D-N.Y.), Morse (Ind-Ore.), Mundt (R-S.D.), Murray (D-Mont.), Neely (D-W. Va.), O'Mahoney (D-Wyo.), Saltonstall (R-Mass.), Smith (R-Me.), Thye (R-Minn.), Wiley (R-Wis.), and Williams (R-Del.) Paired against it were Magnuson (D-Wash.), and Hill (D-Ala.). Total 26-12 Democrats, 13 Republicans, and one Independent, Morse. —**The End**

Oil Advised to Settle Imports Without Congress

Voicing his indignant opposition to the Supreme Court decision in the Phillips case and emphasizing his earnest hopes that no Congressional action in the oil imports controversy will be sought, Colorado's Governor Dan Thornton last month called on the industry to solve **its own** problems.

"If it doesn't," he warned, "it invites government to step in, and through remedial measures by Congress, to capture our own industry. If we succumb to government control, the oil industry—as well as others—will be lost because they cannot exist under government control."

In a talk before the Houston chapter of Nomads, Governor Thornton said he detected an encroachment of socialism in the Supreme Court decision. He said it is time to reflect on changes that are taking place and to decide whether they are the best "for generations to come."

The governor warned that the economies of all states are important and that they should not be sacrificed by a flood of imported oil. "Of course," he added, "we must live with other countries, but the question of how we deal with imported oil should be handled by the industry, not the government."

Discussing the scope of the petroleum industry, Gov. Thornton said it is essential to national military safety and to the economy of practically every community, and, unless the nation acts to preserve and perpetuate a philosophy of government which allows an individual to rise above the masses, it will follow the philosophy of allowing the government to dictate to business.

Thus it is, he pointed out, that the U. S. stands at the crossroads between the two philosophies.

Continuing, he said: "Monopoly is bad whether it's held by industry or labor. But the worst monopoly is the monopoly of government—with power and authority through its decrees and police force. This nation is not in a dogfight between political parties, as some are led to believe. It is, rather, a battle between philosophies.

"We must have a moderate center-of-the-road policy allowing individuals to work out their own policies. Each member of the Democratic or Republican party must be dedicated to the preservation of the American way of life. We need a dose of the old time religion. We must work and sacrifice so that in the next generation a sharecropper's son can become a governor.

"That is what has distinguished America from all other countries," he said.

'Industry's Position Stronger'—Porter

Petroleum use will show its 12th annual gain when the figures are added for 1954, it was predicted by Frank M. Porter, API president.

Porter noted that the statistical position of the industry is considerably stronger than earlier in the year, and even stronger during the late summer. But he indicated that the situation is still such as to advise caution, particularly with respect to crude runs to stills, relative product yields, the demand for fuel oils this winter, and for gasoline in next summer's high-consuming season.

In addition to the slackening in consumer demand, other factors contributing to 1954's slower pace in the domestic industry were a substantial decrease in exports, the post-Korean decline in military requirements, and the modest slump in general business activity.

He said domestic demand during 1954 is estimated at 2 billion, 824 million barrels, up 39 million over 1953. Domestic supply is estimated at 2 billion, 557 million, a decrease of 45 million. Of the latter, 2 billion, 312 million are crude, and 245 million are natural gas liquids. Although the over-all total of liquid hydrocarbons is down, production of natural gas liquids represents another all-time peak. Natural gas output also moved upward, reaching 11 trillion cubic feet, an increase of more than 368 billion cubic feet.

The API president said drilling activity set a new record of 53,000 wells completed, an increase of 3500 over the preceding year. Significantly, more than one-third of these were dry holes, which emphasizes the increasing financial risk in searching for oil, and the correspondingly higher cost of finding new reserves.

Other principal statistics for 1954:

Year-end stocks—719 million barrels, down almost 9 million from 1953.

Operable refinery capacity—8,379,000 barrels daily, up approximately 372,000.

Crude runs to stills—2 billion, 531 million barrels, down 24 million.

Output of refined products included:

Motor fuel—1 billion, 265 million barrels, down 2 million.

Distillate fuel oil—538 million, up 10 million.

Residual fuel oil—415 million, down 34 million.

Total fuel oil—953 million, down 24 million.

Kerosine—122 million, down 825,000.

Proved reserves of liquid petroleum and natural gas were believed to have moved to new peaks in 1954. The report on reserves will not be available for some time, but industry circles expect to see an increase in total reserves as a result of this year's intensive drilling program. At the beginning of 1954, U. S. reserves of liquid hydrocarbons amounted to 34.4 billion barrels, an all-time high.

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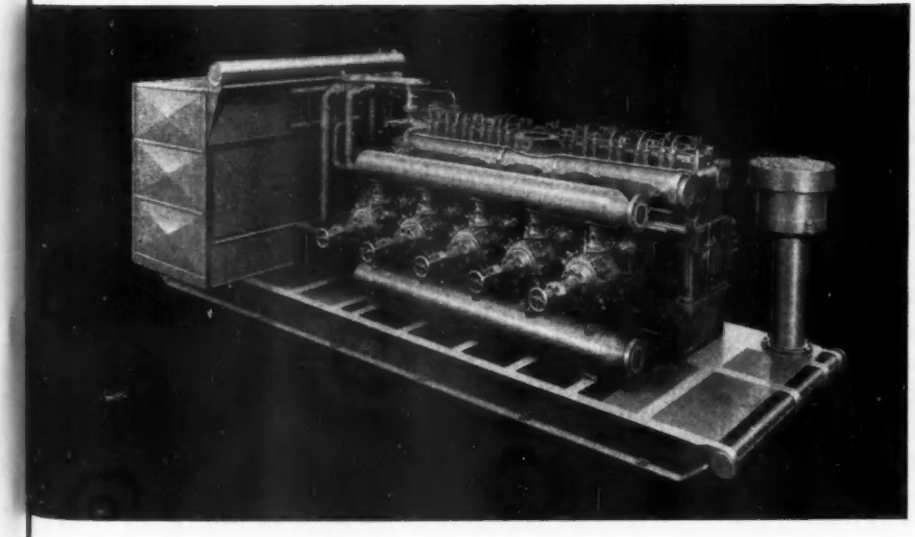

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Clark sets the pace in compressor progress

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Economic Outlook Brightens '55 Picture

FURTHER IMPROVEMENT during the past month makes the petroleum industry's economic outlook better than in a long time. Ahead is an opportunity to avoid excessive motor fuel stocks in 1955, and thus escape the uncertain conditions which have plagued the industry during the past two years.

Everything depends on whether refinery yields of gasoline are held in check during the first three months of 1955. This will not be easy despite the current favorable inventory position. The problem will be to provide enough distillate heating oil without making excessive quantities of motor fuel at the same time.

•

INCREASED REFINERY RUNS are going to be necessary to manufacture sufficient heating oil because of higher demand, and lower levels of inventories. This creates the danger that too much gasoline will be made before the start of the heavy motor fuel consuming season next spring. Just how much refinery runs will need to be increased depends on how cold a winter is experienced. Severe cold weather will necessitate a very substantial boost in crude runs to refinery stills. The higher crude runs become, the greater the danger of creating excessive gasoline stocks.

Heavy withdrawals on distillate stocks have occurred in recent weeks. Despite manufacturing more heating oil than ever before, colder weather than experienced in 1953 caused 13 million barrels to be taken from storage between November 1 and December 10 this year. Only 9 million barrels came from storage during the same period of 1953.

This reduced the inventories of distillate fuel to 124 million barrels, 2⅓ million barrels less than at the same date a year ago although they had been 4 million barrels higher the first of November. If cold weather continues, demand will be considerably above last year and the low level of stocks will necessitate major increases in refinery runs.

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THE INDUSTRY IS IN a far better position to cope with this situation than appeared possible a short time ago. This is the result of excellent adjustment of refinery product yields, coupled with increasing demand.

Refiners have performed a masterful job of regulating product yields to needs during the past four months. Consequently, heavy withdrawals have corrected excessive motor fuel stocks to a large extent.

U. S. inventories of gasoline on December 10 were at the same level as a year before. This represented an amazing improvement. Only a month ago these stocks were 5 million barrels larger than at the corresponding period of 1953, while two months ago they were 10⅓ million barrels higher, and had been 22 million greater than 1953 volumes in June. Much of the improvement results from poor conditions in 1953, when making of excessive quantities held withdrawals of gasoline below normal. Since the end of March, withdrawals of gasoline have amounted to 30 million barrels this year in contrast with the subnormal total of only 12 million barrels in 1953.

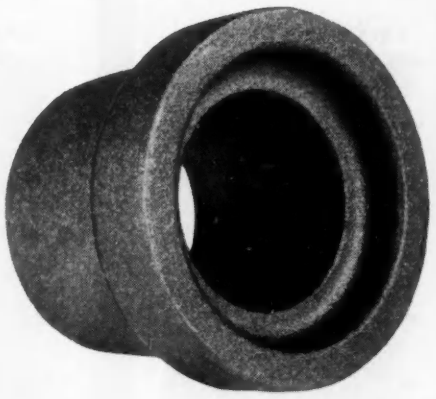
•

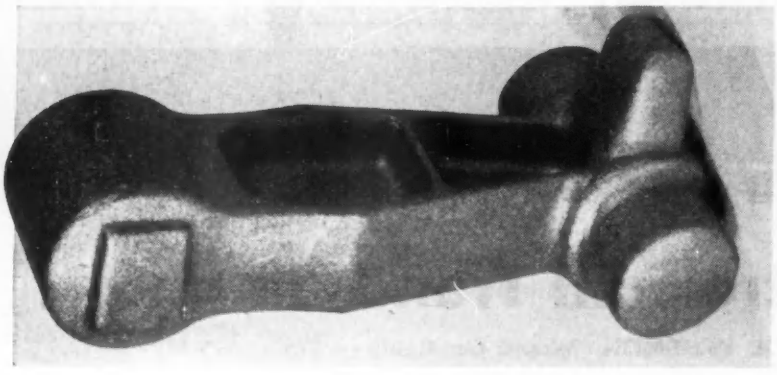
A MAJOR CHANGE in the crude oil production picture is in the immediate offing. Demand for crude will be increased by likely higher refinery runs, and a sharp increase in crude oil production has been scheduled for January.

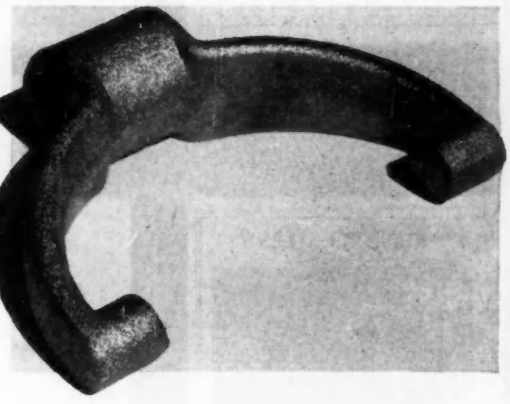
Texas' allowable production for the month has been given a big increase of 257,307 barrels daily. This is the third consecutive month in which Texas' permissible output has been increased. The state's allowable for January will be 385,000 barrels per day larger than in October.

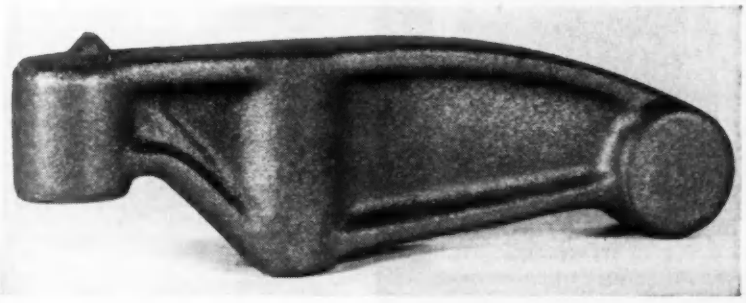
The crude oil situation is in good shape to handle this increase in output, although it may be necessary later to reduce the volume. Crude stocks currently total only 265 million barrels, lowest since September, 1952. They are 12 million barrels below year ago levels, and 20 million barrels less than at the end of June, 1954.

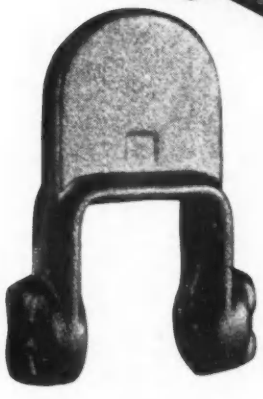
In granting the increase, the Texas Railroad Commission not only took note of the prospects for higher crude demand and lower stocks, but noted that imports of foreign oil had increased in 1954 while domestic crude production declined nearly 2 percent.











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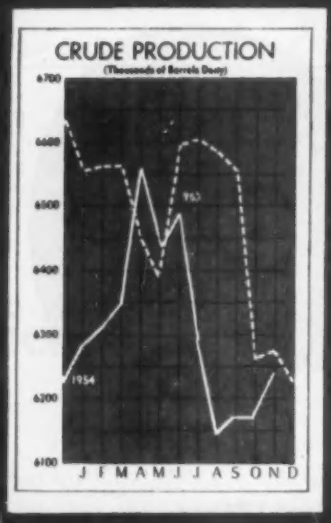
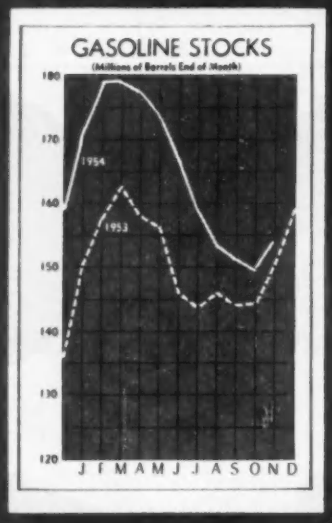
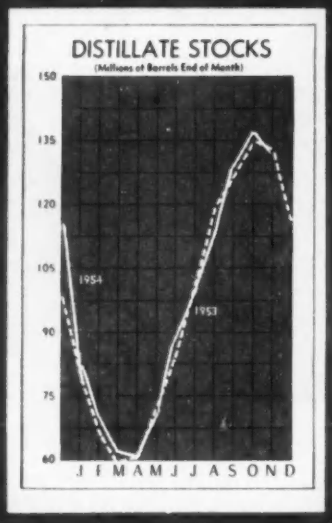
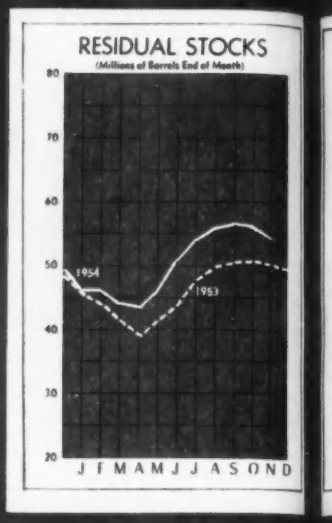
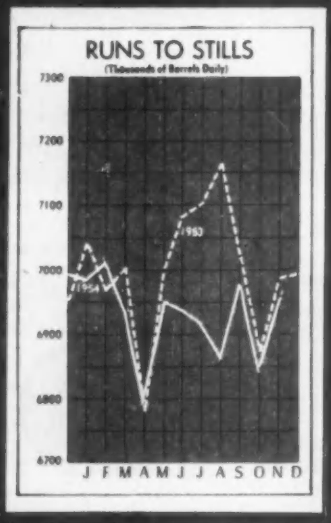
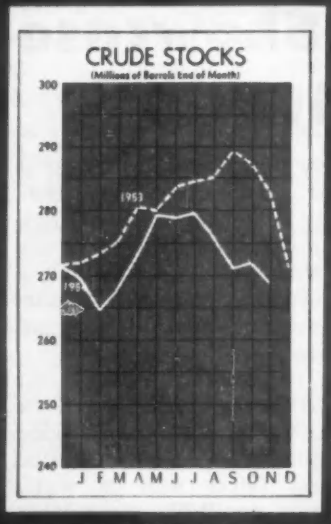












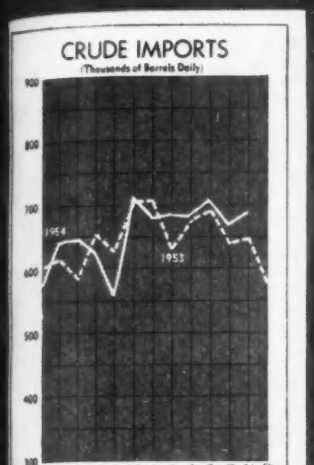
Petroleum Trends in U. S. . . .

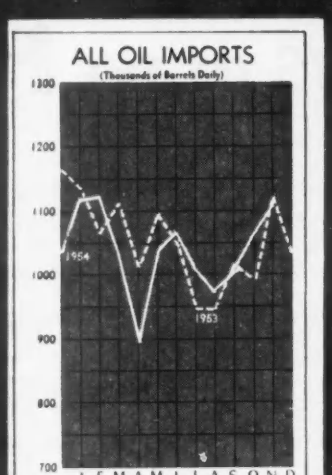
By CECIL W. SMITH, World Oil Staff

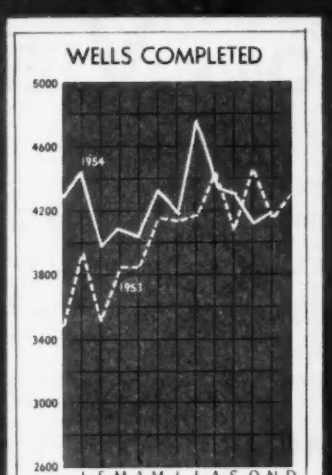
U. S. Crude Production by States

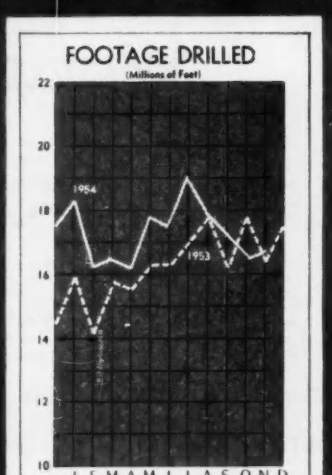
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION Nov., 1954	Oct., 1954	Nov., 1953	% Diff. Nov. '53-'54	TOTAL PRODUCTION First Eleven Months 1954	1953	% Diff. '54-'53
Alabama	4.0	4.2	4.4	— 9.1	1,450	1,561	— 7.1
Arkansas	72.2	74.2	79.2	— 8.8	26,513	27,233	— 2.6
California	961.2	957.0	1,006.0	— 4.5	326,079	333,919	— 2.3
Colorado	141.0	135.8	91.4	+ 54.3	38,381	29,443	+ 30.3
Florida	1.4	1.5	1.5	— 6.7	508	492	+ 3.2
Illinois	188.1	186.0	165.7	+ 13.5	60,160	53,615	— 15.1
Indiana	29.1	28.3	33.4	— 12.9	10,184	11,990	— 15.1
Kansas	320.2	317.6	302.3	+ 5.9	108,830	105,898	+ 2.8
Kentucky	38.4	37.2	32.5	+ 18.1	12,488	10,561	+ 18.2
Louisiana	633.6	627.0	694.0	— 8.7	225,112	234,204	— 3.9
North Louisiana	104.6	106.2	111.5	— 6.2	37,280	38,119	— 2.2
South Louisiana	529.0	520.8	582.5	— 9.2	187,832	196,085	— 4.2
Michigan	32.5	31.9	33.1	— 1.8	11,019	11,234	— 1.9
Mississippi	92.8	94.1	95.2	— 2.5	30,840	32,487	— 5.1
Missouri	0.1	0.1	0.1	.....	64	23	+178.3
Montana	38.9	40.2	33.5	+ 16.1	12,380	10,586	+ 16.9
Nebraska	20.1	19.2	18.9	+ 6.3	6,611	5,651	+ 17.0
New Mexico	208.8	204.7	194.5	+ 7.3	68,107	64,309	+ 5.9
Southeast New Mexico	207.5	203.4	192.1	—+8.0	67,472	63,627	+ 6.0
Northwest New Mexico	1.3	1.3	2.4	— 45.8	635	682	— 6.9
New York	11.1	11.3	9.4	+ 18.1	3,150	3,484	— 9.6
Nevada	0.2	0.1	.....	.....	29	.....	.....
North Dakota	19.4	17.0	14.5	+ 33.8	5,038	4,735	+ 6.4
Ohio	10.9	10.7	10.0	+ 9.0	3,495	3,216	+ 8.7
Oklahoma	494.6	490.3	519.7	— 4.8	171,356	186,331	— 8.0
Pennsylvania	19.8	21.3	27.5	— 28.0	8,275	9,811	— 15.7
South Dakota	0.2	0.1	.....	.....	32	.....	.....
Tennessee	0.1	0.1	.....	.....	14	11	+ 27.3
Texas	2,648.7	2,599.2	2,655.7	— 0.3	896,595	943,853	— 5.0
Dist. 1—South Central	43.7	42.8	38.7	+ 12.9	14,093	12,570	+ 12.1
Dist. 2—Middle Gulf	141.2	137.4	142.7	— 1.1	47,656	52,420	— 9.1
Dist. 3—Upper Gulf	430.7	420.3	442.1	— 2.6	46,397	157,692	— 70.6
Dist. 4—Lower Gulf-S.W.	233.8	231.6	246.9	— 5.3	81,189	87,368	— 7.1
Dist. 5—East Central	43.4	43.0	45.6	— 4.8	14,787	16,383	— 9.7
Dist. 6—Northeast	325.2	315.9	358.3	— 9.2	13,437	126,364	— 89.4
Dist. 7-B—North Central	129.2	133.8	118.2	+ 9.3	42,546	37,849	+ 12.4
Dist. 7-C—West Central	176.6	175.5	159.7	+ 10.6	60,097	55,456	+ 8.4
Dist. 8—West	850.4	823.7	809.6	+ 5.0	284,243	30,555	— 5.7
Dist. 9—North	190.2	188.4	184.5	+ 3.1	62,452	60,965	+ 2.4
Dist. 10—Panhandle	84.2	86.8	76.6	+ 9.9	27,693	25,167	+ 10.0
Utah	5.2	5.4	4.6	+ 13.0	1,733	1,663	+ 4.2
Virginia	0.1	0.1	.....	.....	13	9	+ 44.4
West Virginia	7.4	7.9	9.6	— 22.9	2,690	2,746	— 2.0
Wyoming	246.1	247.0	240.5	+ 2.3	85,045	77,555	+ 9.6
Total United States	6,246.2	6,169.6	6,277.2	— 0.5	2,116,191	2,166,620	— 2.3









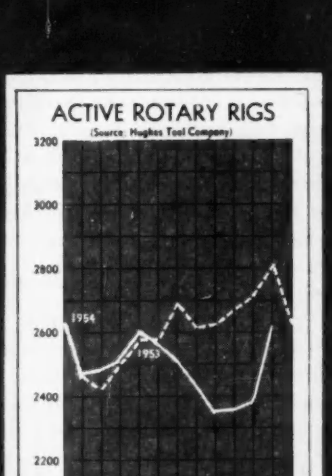
- Crude output highest since June
- Drilling continued at high level
- Oil imports at nine-month high

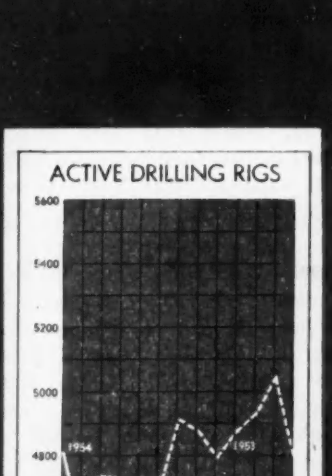
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:											
August...	6,219	7,118	264,368	3,377	118,592	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	1,502	117,252	1,230	56,200	615	932
October...	6,518	6,883	269,776	3,301	120,062	1,458	120,721	1,203	53,052	643	1,037
November.	6,487	7,049	267,852	3,416	129,509	1,510	116,096	1,299	53,069	624	984
December.	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January..	6,555	7,042	272,250	3,384	150,518	1,528	80,655	1,307	45,910	616	1,135
February.	6,562	6,969	273,589	3,379	157,873	1,505	67 167	1,275	44,178	586	1,066
March....	6,531	7,002	275,665	3,319	162,731	1,489	59,802	1,256	41,600	655	1,112
April.....	6,446	6,781	280,487	3,282	158,032	1,424	61,349	1,219	39,572	628	1,010
May.....	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June.....	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July.....	6,603	7,103	284,976	3,583	143.916	1,441	102,394	1,224	47,966	629	946
August....	6,583	7,163	285.352	3,592	146,050	1,437	119.542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October...	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November.	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January..	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February..	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March....	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April.....	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May.....	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June.....	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July.....	6,242	6,916	284,894	3,480	158,010	1,416	101,657	1,089	54,365	724	1,038
August...	6,168	6,862	281,043	3,492	153,168	1,453	117,579	1,069	56,332	664	966
September	6,151	6,939	274,608	3,511	150,916	1,514	128,061	1,086	56,702	672	999
October...	6,170	6,838	271,930	3,343	149,603	1,516	137,096	1,053	56,414	660	1,068
November.	6,246	6,955	267,642	3,408	150,441	1,573	132,925	1,115	54,851	684	1,107
Nov., 1954 Change:											
In Month.	+76	+117	—4,288	+65	+838	+895	—4,171	+62	—1,625	+24	+39
In Year...	—31	—32	—15,379	—120	—306	+110	—456	—108	+3,584	+36	—13
Week Ended:											
12-10-54..	6,341	7,105	265,373	3,513	150,653	1,540	124,067	1,126	52,803	676	1,097
12-11-53..	6,225	6,915	277,410	3,425	150,394	1,473	126,452	1,157	50,455	549	1,096

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





WORLD OIL'S VIEWS OF THE NEWS

• Taft-Hartley to remain intact in new Congress. Tax cuts likely to be delayed. Reciprocal trade act may be extended . . . • FPC kills escalation, favored nation clauses . . . • Texas allowables upped . . . • Coal may be seeking trade-out in gas fight.

Here's Legislative Outlook

What about the legislative outlook in the Democratic-controlled 84th Congress which convenes January 5? Veteran congressional observers take this view of those issues in which oil has big stakes:

Taft-Hartley labor-management act—Will be kept virtually intact. A strong coalition of conservative Southern Democrats and Northern Republicans will see to that. But they'll have to beat back pro-labor, liberal colleagues who know they can't repeal the law but would rewrite it. President Eisenhower will suggest changes, among them a ban against employers hiring non-strikers during a strike, and to require employers, as well as union officials, to sign non-Communist oaths. These amendments may pass. On the other hand, a liberal drive, backed solidly by labor, to scuttle right-to-work laws in 17 states will fail. These laws prohibit compulsory union membership. Taft-Hartley permits this but recognizes the precedence of state laws. Secretary of Labor James P. Mitchell has denounced the laws and wants Taft-Hartley changed to supersede them. Secretary of Commerce Sinclair Weeks upholds them. President Eisenhower has taken no side—as yet. A year ago he suggested the states be given more, rather than less, jurisdiction in labor-management relations. The trend in the National Labor Relations Board is in that direction.

Minimum Wage—Democrats are expected to support Administration proposal to increase national minimum wage—affecting 24 million workers—from present 75 cents-an-hour scale to 80-90 cents. Strong Southern opposition certain but outlook for passage is bright.

Taxes—Corporation and excise cuts due April 1 will be postponed. President has warned the $3 billion revenue involved is needed urgently to reduce a threatened $5-to-$6 billion dollar deficit in fiscal 1955-56 in the face of a $63 billion budget. Democrats expected to see eye-to-eye with this, but may try to repeal sliding-scale tax on dividends and substitute lower exemptions for low-bracket taxpayers. Corporation tax is due to drop from 52 percent to 47. Industry favors it as an incentive to increased production.

Reciprocal Trade—Most Democrats and middle-of-the-road Republicans will support President's request for a three-year extension under which he would be allowed to cut tariffs as much as 5 percent a year for a total of 15 percent. Strong opposition expected from conservative, or protectionist, Republicans as well as oil and coal state legislators who are fighting imports.

Natural Gas—Strong Senate and House blocs organizing to upset Supreme Court decision that Federal Power Commission must regulate the price of natural gas from wellhead to Interstate consumer. (See Page 43).

Anti-Trust and Fair Price Laws—Democrats determined to strengthen anti-monopoly statutes and kill Supreme Court-endorsed state fair price laws. Outcome conjectural.

Atomic Energy—Democrats plan drive to head off President's so-called "give-away" program under which Administration is trying to induce private enterprise to take greater part in exploiting nuclear energy for industrial and other peace-time purposes. Outlook uncertain. In same vein, Democrats will try to kill Dixon-Yates power contract under which the private utility concern would supply energy to Atomic Energy Commission through Tennessee Valley Authority.

Foreign Aid and National Defense—Democrats already have pledged Mr. Eisenhower there will be little controversy in these fields; that he will get substantially what he asks. Some Democrats are inclined to give him even more.

Other issues on which it is too early to prophesy action are health re-insurance which died in the last Congress; safeguards for small business, which will have a loud voice in the new Congress; and expansion of social security to embrace millions of disabled workers.

Escalation Clauses Killed

The Federal Power Commission's new order 174-B has, for all practical purposes, killed escalation and favored nation clauses in natural gas sales contracts. Willard W. Gatchell, commission general counsel, made that unmistakably clear in a statement to WORLD OIL in Washington.

He admitted that what the FPC has done, in effect, is state a new policy which supersedes much of that covered in original orders 174 and 174-A. He emphasized that the commission dislikes both clauses and, through order 174-B, has put the oil and gas industries on notice that neither will be recognized after May 1, when the new order becomes fully effective. He added that if such contracts are negotiated between now and May 1, it will be at the participants' own risk. There may be some exceptions, Gatchell said. But he could call none to mind at the moment.

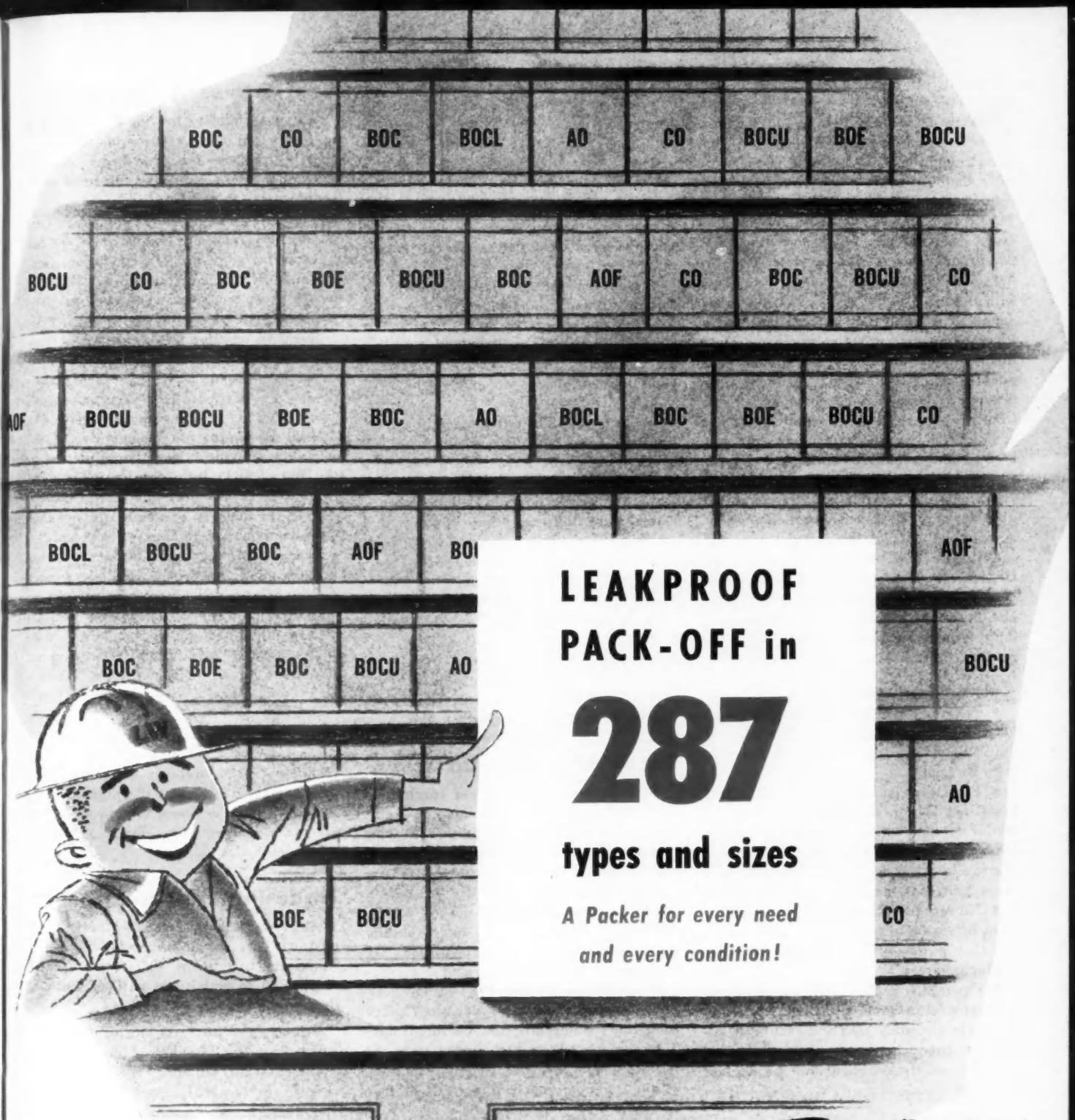
Industry men in the nation's capital agreed that that was what the order meant. They met informally on how it should be interpreted for their various organizations.

Meantime, Federal Judge Alexander Holztoff, in Washington, granted the Union Producing Company, subsidiary of United Gas Pipeline Company, a permanent injunction against FPC enforcement of orders 174 and 174-A on grounds the commission put them into effect without adequate hearings. Next question is what the commission or Union Producing can or will do about superseding order 174.

Industry sources look for Gatchell to return to court with a plea that both old orders have been superseded and therefore the issue raised by Union Producing is moot. He can point out that public hearings were held on the escalation and favored nation issues November 4-5 and that order 174-B is based on them.

It is clear in any event that the industry is fighting a back-and-fill action—what one spokesman termed "buying time"—to delay full enforcement of the FPC's gas price regulations until such time as Congress can pass legislation circumventing the Supreme Court's Phillips case decision that the FPC must regulate the price of gas from wellhead to interstate consumer.

Some industry circles believe 174-B may



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end some of the confusion surrounding powers of state commissions. The order quotes the 1938 Natural Gas Act, as it touches on abandonment of service to producers, and adds that "nothing in the FPC rules shall be construed to interfere with valid conservation orders of a state agency." These same circles, however, foresee this as the basis for lawsuits between the various producing and pipe-line interests.

Industry leaders were much displeased with the commission's failure to give a flat definition of who can be regarded as an independent producer. One spokesman said this leaves the question of the commission's jurisdiction "wide open." Commissioner Seaborn L. Digby agreed in a sharp dissent from 174-B. He warned that "hundreds of producers will file applications and rates in transactions entirely outside FPC jurisdiction." Digby also asserted that all fixed escalations in contracts which were in existence when 174-A was issued "should be accepted as part of the original rate and constituting one tariff on rate schedules not subject to suspension under the Natural Gas Act." But Commissioners Nelson Lee Smith and Frederick Steuck insisted the commission majority had not foreclosed further consideration of these issues.

Highlights of 174-B:

- Acceptance of gas purchase contracts in support of certificate of necessity filings shall not be construed as approval of the rates therein.
- Escalator clauses submitted after May 1 will not be considered in support of any certificate application if they provide for adjustment of a seller's price due to changes in prices received by the purchaser when he resells the gas.
- No recognition of seller's price adjustment by reason of payment of higher prices by other purchasers in the same or other producing areas.
- Operators selling gas in interstate commerce after processing and gathering, can make necessary rate and certificate filings for producers as a group, those co-owned, and those united for production and sale.

Will Ike Back Imports Bill?

Speculation as to whether the next Congress will curb imports through legislation backed by the President was confused by an announcement from on high last month.

It was announced that the Administration will ask Congress to give high priority to a liberalized foreign trade program, including authority for the President to make sharp tariff reductions. Washington observers took this to mean the President would not favor new trade restrictions, including legislative curbs of imports.

The announcement followed by a few days a Fort Worth rally of Texas independent producers at which it was determined to muster all the nation's independents behind congressional legislation to curb imports. (See page 40).

At that meeting:

- Jack Porter, Houston independent and Republican national committeeman from Texas, declared he had been corresponding with the President concerning imports and that the chief executive is concerned over the matter.
- Gen. Ernest O. Thompson of the Texas Railroad Commission also raised the independents' hopes by saying he understood the President's Cabinet committee was giving careful study of the effects of imports on the over-all economy of the nation.
- Sen. Price Daniel of Texas, who certainly recognizes the value—if not the absolute necessity—of the President's approval of imports-curbing legislation, promised to push toward legislation any "reasonable plan" adopted by the nation's independents. Daniel also declared that congressional action seems the only answer to the imports problem, "industrial statesmanship" apparently having failed.

Meanwhile, in Washington, Senate Majority Leader Lyndon B. Johnson, another Texan, was reported to have given the President a pledge of general support for his foreign trade program, which is expected to include a three-year extension of the Reciprocal Trade Agreements Act.

Texas Allowable Up Again

Gen. Ernest O. Thompson carried his fight against high imports into the Texas Railroad Commission's proration hearing and emerged with a 257,307-barrel hike in the permissible flow for January.

The allowable was set at 3,216,123 barrels. This exceeds the 1954 peak of 3,115,463 barrels reached in April, but is substantially below the all-time high of 3,387,279 set in November, 1952.

Declared Thompson: "We've been showing great restraint on production, while some other states have not. We might have a bad winter . . . which would open the way for people to say we need more imports. If sotcks pile up, maybe importers will take heed."

An 18-day pattern was adopted after Gen. Thompson and Commissioner Olin Culberson said it would help combat imported crude and would prevent a possible shortage during the winter heating oil season.

W. J. Murray, Jr., who was elected chairman for 1955-1956 to succeed Gen. Thompson under the commission custom of annually passing the chairmanship among the members, declared the increase was so large that it made him "nervous." He agreed to it with the comment that industry should recognize the probability of a cut-back if stocks increase.

Only Sun Oil Company and Shell Oil Company actually recommended the 18-day schedule.

Coal Craves to Bargain

The coal industry last month threatened to force into close relationship oil's two great problems—the overthrow of the Phillips gas decision, and easement of oversupply.

Throughout the long Phillips case coal has clamored no less loudly than oil for freedom from government regulation. Coal reasoned that an unregulated gas industry would boost gas prices to a level competitive with coal.

But last month coal struck up a new tune that sounded like an overture to a bargaining session. L. C. Campbell, president of the National Coal Association, reporting on a Washington meeting of a Special Committee on Competitive Fuels, said "the committee gave consideration to the so-called Phillips decision . . . but the committee at this time has taken no position on the question of whether or not that decision should be retained or reversed."

Speculation was that coal was offering to back oil's stand in the Phillips case for a price. Conceivably, that price might be oil's backing or import quotas on residual oil. Campbell said the National Coal Association favors "quantitative restriction on such imports and an equalization of tariffs on residual oil with other petroleum products."

Coal might also be prepared to demand gas cooperation on coal's drive against "dumping of natural gas at a price less than the average cost at the point of consumption, plus a reasonable profit," and for coal's demand that imports of natural gas be curbed.

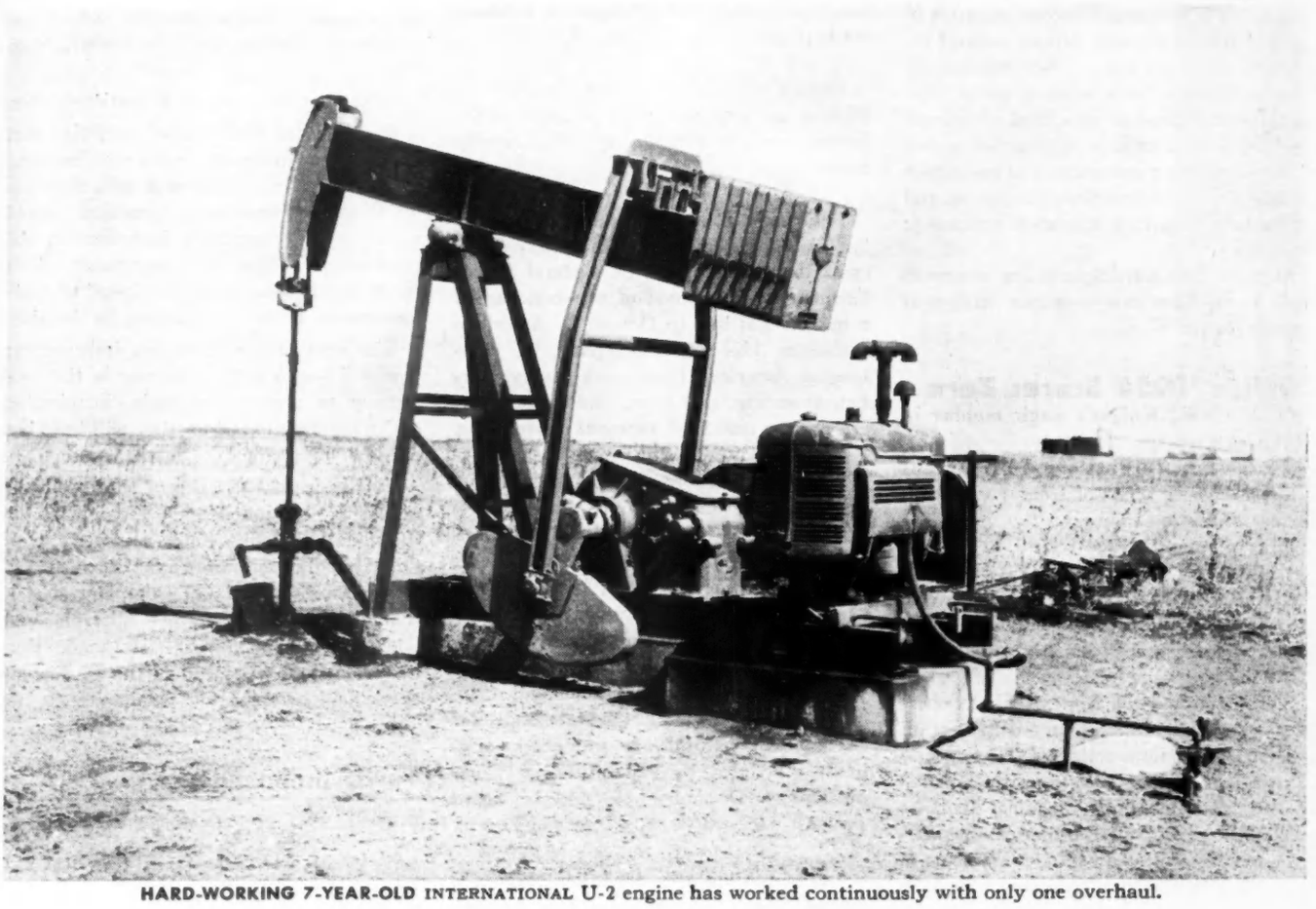
Trade Parley Open to Oil

At New Orleans, Feb. 28-March 3, oil men can get in on an ambitious Inter-American Investment Conference which could lead to activity in nations south of the border.

Primary purpose of the conference—which President Eisenhower has personally endorsed—is to stimulate the flow of private U. S. capital into Latin-American manufacturing and industrial projects. But officials of the International Development Advisory Board in Washington said oil and gas men would be most welcome. Idea for the conference originated among a group of New Orleans business men who won enthusiastic response from representatives of private industry and finance in Latin-America, the Organization of American States, and the IDB headed by Eric Johnston. As a feature of the session, Latin-American businessmen will propose specific projects in which investment of U. S. money would be welcome. More than 50 such projects have been blueprinted.

Potential suppliers and borrowers will be brought together, giving the meeting prac-

Runs 7 Years on the Pump Jack with Only One Overhaul



HARD-WORKING 7-YEAR-OLD INTERNATIONAL U-2 engine has worked continuously with only one overhaul.

Rugged IH engine pays off in Pampa, Texas

For over seven years, a sturdy INTERNATIONAL U-2 engine has been working away for Cree Production Co., down in Pampa, Texas.

Pumper H. N. Sanchez gives the low-down:

"These INTERNATIONALS *are tops for oil field work. They sure start easy and run for years and years. This is one of the first U-2s to come out, and it's only had one overhaul in all these years. One thing for sure, these* INTERNATIONAL *engines don't fall apart on the job!"*

On both small and large operations, smooth-running, multicylinder INTERNATIONAL engines have made a reputation for reliability among oil men everywhere.

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tical significance beyond that of earlier, and less fruitful, sessions.

Last July 19, Mr. Eisenhower wrote Johnston:

"The suggestion that representatives of private business, industry and finance in the U. S. and Latin America take the initiative in organizing a privately-sponsored conference to promote economic progress in Latin America through private capital investment is a good one . . . The administration looks with favor upon positive, forward-looking steps of this kind of private enterprise. We also urge appropriate action on the part of our government to encourage outflow of private American investment and on the part of foreign nations to encourage its inflow."

At least 100 participants are expected from Latin-American countries and even more from the U. S.

OWIU's 1954 Score: Zero

O. A. (Jack) Knight's magic number in 1954 was zero.

That is exactly what the OWIU president scored in a series of frontal and flank attacks on the oil industry.

Here is Knight's 1954 record, in brief:

Wage increases won: None. He charged the industry took advantage of his no-strike pledge, now withdrawn, to impose a collusive freeze-out against demands for a general 5 percent wage hike.

Successful mergers: None. Knight's cherished plan for a million-man coalition of oil and chemical unions collapsed. He hopes to salvage part of it by merging with the CIO United Gas, Coke and Chemical Workers in February. But that proposed 200,000-man combine still can explode. Elements in the UGCCW will not go along if there is any chance their union will be "swallowed up."

Moreover, President Dave McDonald of the CIO United Steel Workers, who has no use for CIO President Walter Reuther, a sponsor of the OWIU-UGCCW merger, has offered the chemical workers a huge organization fund if they'll align with the steel workers. Time will tell how tempting that bait is.

On the other side of the ledger, Knight achieved moderate success in a membership drive.

'Inch' Hearings Begun

Federal Power Commission indicated last month that its interest in the proposal by Texas Eastern Transmission Corporation to convert a part of the "Little Inch" pipe line system from natural gas to oil products is the effect on gas consumers.

Thus, FPC's decision on the matter will be based on whether the "Little Inch" may be taken out of gas service without affecting adversely the public market. American Pipe Line Corporation and barge line operators were appearing at the hearings to oppose the conversion proposal.

In brief . . .

Federal Power Commission hearings on an application by Northern Natural Gas Company of Omaha, Neb., to import 100 Mmcf. daily of natural gas from Canada into several of the company's midwest markets are to start January 4.

Kuwait Oil Company and the Sheik of Kuwait are expected to soon begin negotiations on the revision of 1951 royalty terms.

Panhandle Eastern Pipe Line Company has filed a protest with Philadelphia Circuit Court of Appeals on Federal Power Commission's approval of the building of a natural gas line to Detroit by American Louisiana Pipe Line Company. In challenging American Louisiana's supply, market, financing, and rates, Panhandle Eastern charges that FPC approval was in error.

Barring unfriendly government attitudes and too many political and military upsets in the world, J. T. Duce, Arabian American Oil Company vice president, believes natural gas pipe lines will be built from Middle East fields to Europe, India and Pakistan some time in the future.

Oral arguments on methods and principles for determining the rate base for independent natural gas producers, originally scheduled by Federal Power Commission on December 15, will be heard January 11.

In computing the depletion allowance for petroleum and other minerals, production charges for plant or equipment use should be included in the gross depletable income of the lessor, not the lessee, of property, according to an Internal Revenue Service interpretation of regulations.

Tide Water Associated Oil Company will spend more than $127 million this year on exploratory operations, refining and distribution. This is the largest sum ever budgeted by the company for a single year's capital outlay.

F. M. Banks, president of the American Gas Association, was the lone new member among the 62 appointed to the Gas Advisory Council by Interior Secretary Douglas McKay. The council consults with McKay and the Oil and Gas Division on natural and manufactured gas matters involving national defense.

Iran Oil Deal Rules Listed

An internationally-known accounting firm, Price Waterhouse and Company, New York, has been picked by the U.S. State Department to serve as a contact point between independents interested in participating in the Iranian oil consortium and the consortium itself.

Earlier, the department, after high-level discussions, decided to play a mild hand by helping independent companies interested in buying into the consortium make their requests known to the consortium members (WORLD OIL, December, Page 89).

Procedure for interested parties is this:

Should Price Waterhouse determine that an interested company meets requirements, the U.S. State Department will find out whether the Iranian government would approve the company's inclusion in the consortium. Then, each company which meets requirements will be allowed to study agreements before announcing its decision.

The next step will be for independent companies who will participate in the consortium to agree upon their organization and representation, since they will have but one seat between them in the consortium.

Finally, actual transfer of shares will be made to the independent companies by the five U.S. consortium members—Gulf Oil Corporation, Socony-Vacuum Oil Company, Standard Oil Company (N.J.), Standard Oil Company of California, and The Texas Company. Shares made thus available to all an eighth of the 40 percent share held by these five companies.

Texas Independents

Continued from Page 40

which we advocate is in the best interest of the entire nation."

Senator Price Daniel, who earlier in the meeting had promised to act on "any reasonable plan," later accepted the program through inference by urging that producers in other states be told about it and brought into the fight along with their congressmen.

By and large, the discussion was kept on the high plane of national security through the salvation of the domestic oil industry by curbing imports. But there were bound to be exceptions among a group accustomed to calling a spade a spade and then digging a slush pit with it. Declared Jack Porter: "Importers are not doing anything I wouldn't do or you wouldn't do in their place. But there are more of us than of them, and if we work together we can get the job done."

The program was adopted without a dissenting "nay." —**The End**

Mr. "B" was in a BIND

When Mr. B. came to see us he was in a bind. He had borrowed on his properties in East Texas to buy some production in Louisiana. Now he discovered that he had a unit which was costing too much to operate. He told us that if he could buy the adjacent property he could work it with no additional equipment and get out of the woods.

We looked into his problem thoroughly, and when he returned we had two proposals to make. We told him we'd lend him enough to buy the new land, so that he would need only $30,000 in cash. But then we asked him if he had ever considered selling his part. We showed him the tax advantages and the excellent cash position it would put him in. He understood what we were telling him, and he sold. He got out from under a bad deal with enough cash to get into a deal which did pay out for him.

We lost the opportunity to make a loan, you say. Yes, but lending is not our only function. In the Oil Loan Department at The National Bank of Commerce we are trying to help and to develop independent oil men. If you have a difficult problem which needs impartial appraisal and advice based on experience, come to see us. This sort of help is why oil men **going up** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

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U. S. Wells Completed in November and First Eleven Months, 1954

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED											DETAILS FOR JANUARY-NOVEMBER					Rigs in Operation		
								TOTAL NEW WELLS			Total Footage Nov., 1954	New Wells			Footage				
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Nov., 1954	Oct., 1954	Nov., 1953		1954	1953	Percent Diff.	1954	1953	Nov. 30, 1954	Oct. 31, 1954	Nov. 30, 1953
Alabama				5				5	5	9	18,165	67	98	— 31.6	348,444	501,891	5	7	7
Arizona			1					1			6,490	9	6	+ 50.0	37,264	19,960	1		1
Arkansas	22			21				43	50	60	154,919	533	489	+ 9.0	1,878,764	1,829,939	34	28	41
California	168		5	53				226	146	183	1,009,014	2,221	2,366	— 6.1	10,144,534	10,357,274	250	239	280
Colorado	31		7	78				116	118	68	647,051	1,190	641	+ 85.6	6,546,272	3,319,026	78	78	53
Florida				1				1	1	2	7,020	28	31	— 9.7	177,631	200,367	2	2	3
Georgia									1	2		8	9	— 11.1	20,508	24,804			3
Idaho													4	—100.0		22,748	1		
Illinois	167		1	120	1			289	330	237	697,039	2,927	1,976	+ 48.1	7,109,882	4,933,455	325	309	265
Indiana	22		2	49				73	78	105	115,081	788	1,213	— 35.0	1,199,818	2,029,627	120	118	179
Kansas	162		26	128			1	317	309	311	1,130,758	3,801	4,090	— 7.1	13,483,039	14,198,875	490	414	436
Kentucky	47		16	65	1			129	114	92	256,415	1,273	1,079	+ 18.0	2,397,952	2,115,585	90	91	95
Louisiana	204	13	19	105				341	293	313	2,055,639	3,322	2,476	+ 34.2	20,614,053	17,012,162	314	297	270
North Louisiana	123	1	8	60				192	155	165	581,566	1,770	1,118	+ 58.3	5,258,348	3,977,713	58	68	56
South Louisiana	81	12	11	45				149	138	148	1,474,073	1,552	1,358	+ 14.3	15,355,705	13,034,449	256	229	214
Maryland													5	—100.0		19,715	3	4	1
Michigan	17		3	23				43	52	59	130,673	508	567	— 10.4	1,389,306	1,456,125	103	103	89
Mississippi	14		1	28				43	42	39	329,883	395	379	+ 4.2	2,789,041	2,606,583	47	46	32
Missouri									2			11	25	— 56.0	11,798	20,645	3	1	1
Montana	18		2	13				33	22	21	159,447	314	390	— 19.5	1,270,472	1,728,246	43	41	55
Nebraska	12		2	27				41	42	26	233,261	408	300	+ 36.0	2,280,550	1,545,527	37	21	13
Nevada									1			11	8	+ 37.5	56,156	11,115	4	3	3
New Mexico	37	1	27	16				81	86	118	379,756	1,066	1,345	— 20.7	5,622,123	7,609,512	105	111	165
New York	13				8			21	21	81	29,261	493	853	— 42.2	716,664	1,189,911	45	57	102
North Carolina													1	—100.0		1,570			
North Dakota	13			10				23	28	30	170,937	261	242	+ 7.9	1,829,583	1,744,080	25	22	26
Ohio	39		25	21				85	119	103	219,760	978	908	+ 7.7	1,958,903	1,847,123	192	193	213
Oklahoma	336	4	24	191			3	558	611	537	1,902,794	7,163	6,539	+ 9.5	24,422,759	22,876,117	672	711	620
Oregon																	1	1	
Pennsylvania	18		18	7	14	5		62	59	137	121,991	871	1,497	— 41.8	1,606,871	2,574,686	127	132	276
South Dakota				2				2	1	5	5,802	19	21	— 9.5	98,629	95,509	1	1	2
Tennessee										1			2	—100.0		3,403			
Texas	848	14	68	556	11		2	1,499	1,417	1,464	6,410,135	16,723	15,533	+ 7.7	74,719,355	70,913,788	1,302	1,261	1,441
Dist. 1: South Central	64	1	4	47				116	86	78	333,745	1,044	788	+ 32.5	3,427,059	2,520,061	40	45	32
Dist. 2: Middle Gulf	26		10	33				69	66	67	440,293	752	718	+ 4.7	4,607,888	4,424,260	31	49	50
Dist. 3: Upper Gulf	74	2	2	66				144	133	162	924,468	1,597	1,527	+ 4.6	10,641,145	10,271,782	127	125	142
Dist. 4: Lower Gulf-S.W.	43	9	3	49				104	111	129	565,047	1,304	1,685	— 22.6	6,818,992	9,599,835	75	70	87
Dist. 5: East Central	5		1	25			1	32	14	27	146,627	259	258	+ 0.4	1,013,622	1,043,063	20	19	15
Dist. 6: Northeast	29		14	26				69	61	48	379,374	674	465	+ 44.9	3,921,468	2,760,705	61	61	65
Dist. 7-B: North Central	138		4	112				254	237	271	762,429	2,704	2,882	— 6.2	8,590,529	9,361,407	142	126	157
Dist. 7-C: West Central	66		2	29	1			98	88	89	526,732	1,178	1,204	— 2.2	6,160,630	5,946,827	127	118	170
Dist. 8: West	176	1	5	33				215	190	221	1,194,047	2,599	2,151	+ 20.8	15,370,340	12,292,323	356	329	355
Dist. 9: North	189		6	132	10			337	368	311	940,015	3,740	3,352	+ 11.6	11,267,745	11,105,084	252	254	256
Dist. 10: Panhandle	38	1	17	4			1	61	63	61	197,358	872	503	+ 73.4	2,899,937	1,588,441	71	65	112
Utah	1			6				7	9	8	13,292	63	75	— 16.0	277,515	399,657	22	25	17
Washington				1				1			3,737	1			3,737		1	1	1
West Virginia	5		30	10				45	54	32	122,648	513	548	— 6.4	1,482,513	1,535,966	163	175	198
Wyoming	48		4	31				83	96	92	452,535	1,058	782	+ 35.3	5,600,838	3,945,119	79	89	159
Total United States	2,242	32	281	1,567	35	5	6	4,168	4,107	4,135	16,783,503	47,023	44,498	+ 5.7	190,094,974	178,690,110	4,685	4,581	5,047
Total Western Canada	135		16	73			1	225	206	211	877,680	1,969	2,045	— 3.7	7,735,123	8,407,505	189	142	170

Completions Continue High

4168 new wells in November boost year's total to 47,023, five percent over 1953.

THE HIGH RATE of activity that has characterized this year's drilling campaign was continued through November and no signs of a let-up during the final month can be seen. A total of 4168 new wells was completed during the month to boost the year's total to 47,023 wells, which proved to be an increase of more than 5 percent over last year's record-breaking operations.

There can be no doubt that this year's efforts will go into the record books as the greatest of them all. Possibility that the grand total will hit 51,000 wells is almost a certainty, and never before have new wells totaled 50,000 in a single year.

To make the record even more remarkable, a comparison of footage drilled shows that a gain of more than 6 percent was made in that category. So far, a total of 190,094,974 feet was drilled this year against 178,690,110 feet in the same period of 1953.

This year's stepped-up operations have been accomplished with fewer drilling rigs than were being used last year. An average of about 4785 rigs were kept busy in 1953 to accomplish the year's work, while around 4630 have been on the job this year to do the somewhat larger job.

Almost all areas saw drilling activity climb this year, however, there were a few that did not fare so well. Out of the top five drilling states only one experienced a cutback, while the other four showed considerable gains. Texas, by far the leading state, hiked its operations by 7.7 percent over last year, and is heading for its greatest year. The No. 2 state, Oklahoma, upped its drilling to finish 9.5 percent more wells.

Louisiana, with one of the larger increases, holds an 34.2 percent advantage over last year, and is firmly in fourth place in the nation. Illinois' drilling hike of 48.1 percent pushed that state into fifth position, beating out last year's fifth place holder, California.

Water Analyses Help Identify Formations

Systematically filed records of analyses of waters from wells help geologists identify and correlate formations.

By **JOHN F. SAGE,** Sinclair Research Laboratories, Tulsa

SAMPLE WATERS from all drilling wells in a particular field or area, when analyzed and filed under a suitable pattern system, can prove very valuable in geologic correlation work, and can be used as criteria in identification.

Water patterns for correlating waters have been used for many years. Today, a system developed by Henry Stiff[4] makes it much easier for geologists to build up a file of analyses and patterns containing information on all formation waters. This pattern system and how it is applied will be described graphically, following a general discussion on water analysis pertinent to the subject.

In 1911 Chase Palmer,[1] then with the U. S. Geological Survey, invented a method of analyzing natural waters so they might be used for geochemical interpretation. Palmer's system emphasizes the important difference between waters in geochemical relationship. He groups those radicals that are either geochemically similar or geologically associated. Palmer's system is still used today by chemists doing water analysis work.

Method of Analysis. Palmer started by grouping first the common bases, sodium and potassium as alkalies (Figure 1); calcium and magnesium as alkaline earths; carbonate, bicarbonate, and sulphides as weak acids; chlorides, sulfates, and nitrates as strong acid. The reacting values are calculated in percent of the radicals. Using the four groups, Palmer separated natural waters into four classes, according to the reacting values of the radicals. The four classes are primary and secondary salinity, primary and secondary alkalinity. Alkalies in connection with strong acids cause primary salinity. If the strong acids are greater than the alkalies, excess of the strong acids with an equal value of alkaline earths induces secondary salinity.

Primary alkalinity is excess of alkalies over strong acids, with equal value of the weak acids. Secondary alkalinity is excess of the weak acids combined with an equal value of alkaline earths. Secondary salinity and primary alkalinity are incompatible. Each natural water will have two or three of these properties of reaction but never all four. In addition, the percentages of chlorides, and sulphate salinity are computed and may be used as criteria for comparison.

Classification of Waters. Primary salinity is common to all waters. Water having primary alkalinity contains silica and is a good solvent of granitic rocks. Surface waters of mountain ranges are an example. A water characterized by secondary salinity is permanently hard and is ordinarily derived from marine deposits. A secondary alkaline water is temporarily hard

Sinclair Prairie Oil Company
WATER ANALYSIS (SALT)

Sample No. S-7650 Analyst G.G.H. Formation Bartlesville
Depth 2928 Description Sinclair Oil & Gas Company R. S. Litchfield No. 28.
Sec. 21-17N-7E Creek County State Oklahoma
Taken 4-17-47 Rec'd 4-21-47 Analysed 4-25-47

Constituents in Parts Per Million		Reacting Values in Percent	
Sodium (Na)	55,841	Alkalies Sodium	39.98
Calcium (Ca)	8,615	Alkaline Earths Calcium	7.08
Magnesium (Mg)	2,175	Magnesium	2.94
Iron (Fe)		Iron	
Bicarbonate (HCO_3)	44	Weak Acids Bicarbonate	0.01
Sulfate (SO_4)	114		
Chloride (Cl)	107,612		
		Strong Acids Sulfate	0.04
		Chloride	49.95
Silica (SiO_2)	660		
Total Solids	175,561	Specific Gravity at 15.6° C.	1.125

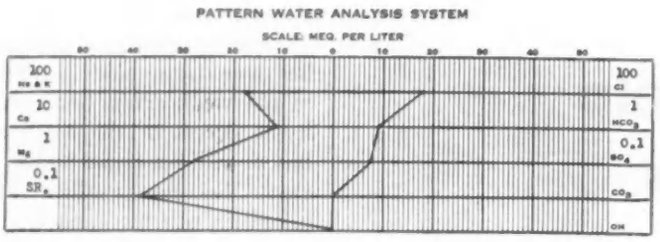
Properties of Reaction in Percent

Primary Salinity 79.96 Chloride Salinity 99.92
Secondary Salinity 20.02 Sulfate Salinity .08
Primary Alkalinity
Secondary Alkalinity .02 P. H. 5.92 @ 23 °C.

Hypothetically Combined As:	Parts per Million	Grains per Gallon
Magnesium Bicarbonate	53	3
Calcium Chloride	2385.8	1391
Magnesium Chloride	8366	488
Sodium Chloride	141989	8278
Magnesium Sulphate	143	8

Remarks: "This is Bartlesville Water". J. F Sage

Fig. 1—Analysis sheet employing the Palmer system of analyzing natural waters so they may be used for geochemical interpretation. Properties of a water may indicate what formation it came from.



SINCLAIR RESEARCH LABORATORIES, INC.
Tulsa, Oklahoma

Sample No. S-4116 Analyst M.E.T. Formation Wilcox (Campbell Sand) D.S.T. Depth 6362'-6365'
Description Sinclair Oil & Gas Company, Hogue Esperance No. 2, Sec. 9, 5N, 9E
County Concordia Parish State Louisiana Taken 9-7-52 Rec'd 9-8-52 Analyzed 9-8-52

Constituents in Parts per Million			Meq. Per Liter	Reacting Values In Percent
Potassium (K)	198	Alkalies Potassium	5.06	0.13
Sodium (Na)	41,924	Sodium	1822.83	46.51
Lithium (Li)		Lithium		
Calcium (Ca)	2,000	Alk. Earths Calcium	99.80	2.55
Magnesium (Mg)	340	Magnesium	27.96	0.71
Barium (Ba)		Barium		
Strontium (St)	170	Strontium	3.88	0.10
Manganese (Mn)		Manganese		
Carbonate (CO_3)		Weak Acids Carbonate		
Bicarbonate (HCO_3)	549	Bicarbonate	8.99	0.23
Hydroxide (OH)		Hydroxide		
Sulphate (SO_4)	37	Strong Acids Sulphate	0.77	0.02
Chloride (Cl)	69,141	Chloride	1949.78	49.75
Total Solids	114,359	Specific Gravity at 15.6 °C.	1.081	pH 6.70 @ 78 °F.

Properties of Reaction in Percent

Primary Salinity 93.48 Primary Alkalinity Chloride Salinity 99.96 Res. 0.0695 O.M. @ 24°C.
Secondary Salinity 6.06 Secondary Alkalinity 0.46 Sulphate Salinity 0.04 Na Cl Eq. 109,720 P.P.M.
Remarks "This is Campbell Sand Water." J. F. Sage

Fig. 2—Form used by author's company for reporting water analyses. It provides for more data than the form shown in Figure 1, the additional data now being easier to determine, through a new laboratory technique.

and ordinarily comes from calcareous beds.

Chemical Changes in Waters. Meteoric waters falling where formations outcrop migrate into the formations for long distances toward the lowest parts of the structural basin.[2] Some of the changes that take place in the subsurface connate sea water are complex and many are highly speculative. Two changes in particular are important; namely, the absence of the sulfate radical and of the alkaline earths in some waters, both being present in normal sea water. For many years investigators believed that the absence of the sulfate radical in some waters was due to bacterial action, the bacteria changing the sulfate to sulfide. We now have definite proof that in some formations this reaction does take place. We also know that where we find barium in waters we find but very small amounts of sulfate, and in most cases none at all. This condition is due to the fact that barium sulfate is insoluble in water. The barium exists in the water as a chloride, and if a water containing barium chloride comes in contact with a water containing the sulfate radical, barium sulfate forms, and being insoluble in water, immediately drops out of solution.

We have also found that where we have little or no alkaline earths (calcium and magnesium) present in formation waters, we find beds of bentonite. Bentonite is a hydrous silicate of alumina with base exchange properties and will absorb ions of higher valence. It seems likely that the bentonite has caused the removal of calcium and magnesium from these waters.

The hypothetical combination of the radicals is calculated and appears in the table at the bottom of the analysis sheet (Figure 1).

Present Form Used to Report Analysis. The present form used by the writer's company for reporting water analyses is shown in Figure 2. Under "Constituents" potassium and sodium are reported separately. This is possible by using a flame spectrophotometer. The older analyses required three to four days for completion. Sodium and potassium were not determined separately because of required additional time and expense. Since the positive and negative radicals must be equal in a water solution, sodium and potassium were reported as sodium and determined by calculation.

With the use of the flame spectrophotometer we now can make a complete analysis of the water in one hour. This eliminates expensive shutdown time of drilling wells. With the spectrophotometer we can determine the quantities of sodium and potassium present. We can determine quantitatively other positive elements or radicals although they may be present in minute quantities. Only five cubic centimeters of the water sample are required for the test. Boron, lithium, barium, strontium, manganese, and nickel have been found in waters.

The reaction capacities of radicals of salts dissolved in water are the quotients obtained by dividing the weight of each radical by its corresponding equivalent combining weight. The quotients are called the reaction coefficients of the radicals. By multiplying the parts per million of the constituents by the reaction coefficients we obtain the milliequivalents per liter. The milliequivalents per liter are used

to plot the water pattern that appears at the bottom of the analysis sheet.

The reaction values in percent and the properties of reaction are calculated as before. To the right of the properties of reaction in percent is the pH, resistivity and sodium chloride equivalent. The pH indicates whether a water is acid or alkaline. Seven is neutral. Below seven is acid, and above seven alkaline. Those who do electric log interpretation know how necessary it is to have the resistivity measurement of the formation waters. Resistivity of waters varies with temperatures, and both the quantity and type of salts in solution.

The sodium chloride equivalent is calculated from the hypothetical combinations. If the resistivity of a water is measured in the laboratory the sodium chloride equivalent is not necessary. However, if the resistivity measurement were not made on the water at the time the analysis was made and a sample of the water is no longer available it is possible to calculate the sodium chloride equivalent from the old analysis and by using Park Jones'[3] figure (Figure 3), find the true resistivity of the water at any given temperature.

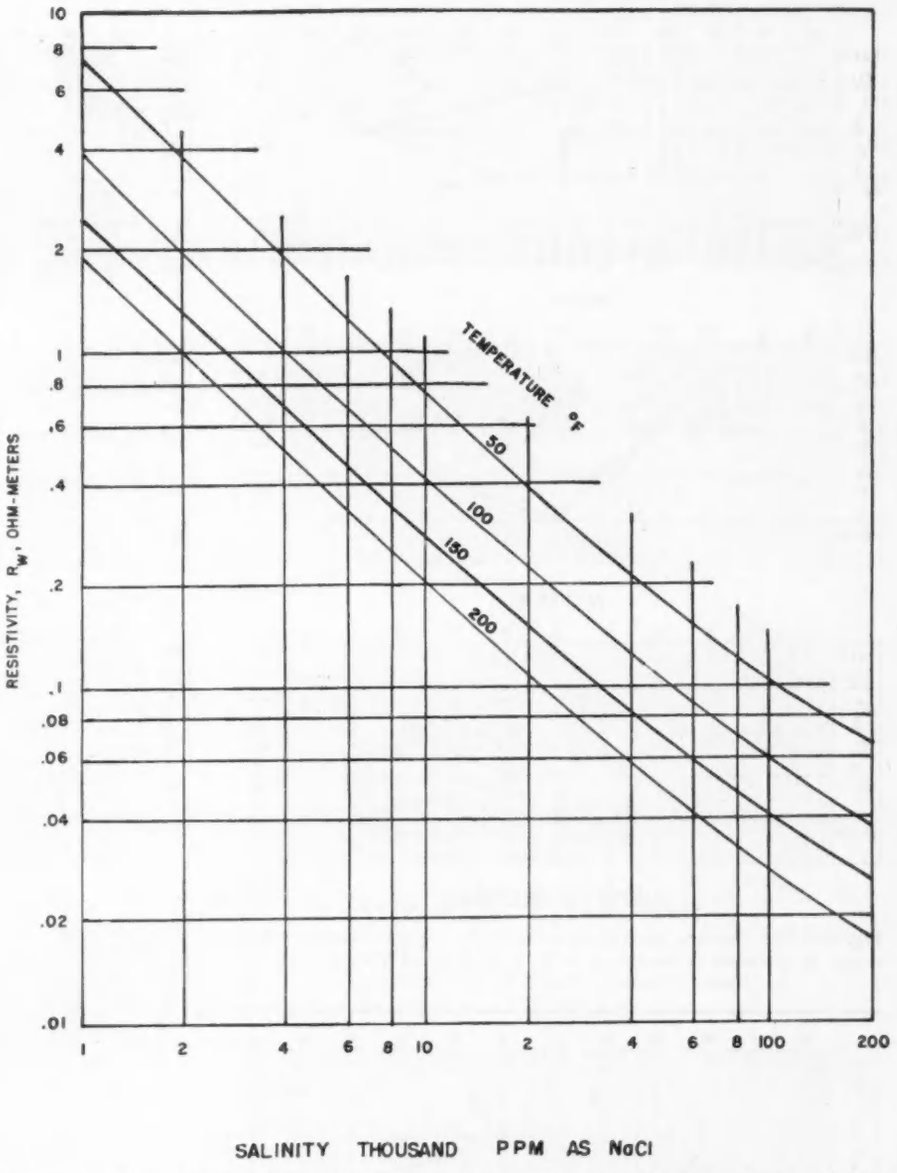


Fig. 3—If the resistivity of a water was not measured in the laboratory in an original analysis, and a sample of the water is no longer available, the resistivity may be calculated. From the record of the old analysis, it is possible to calculate the sodium chloride equivalent and then, by using the Park Jones method, to find the true resistivity of the water at any given temperature.

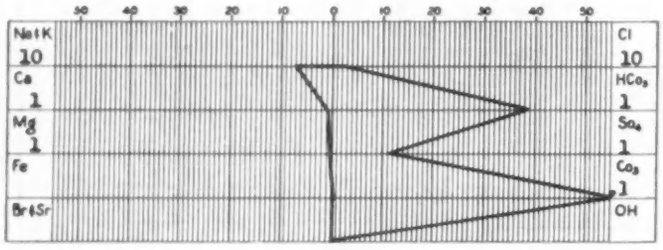
Water Patterns. The pattern system brought out by Stiff and mentioned earlier in this article consists of horizontal lines extending left and right from a vertical line at zero. Positive radicals are plotted to the left and negative radicals to the right. The figure above each radical gives the scale that the radical is plotted on. Each radical is plotted on the smallest scale possible.

Figure 4 shows how the pattern system can be used to correlate waters. Assume that we have drilled the well to formation B and squeezed off formation A, which lies a few hundred feet above formation B. A drill stem test of formation B encountered water, of which a sample was taken and sent to the laboratory for analysis. The pattern of this water plotted on Figure 4 is marked "water in question." Patterns for formations A and B waters are marked water "A" & "B." They have been plotted from water samples known to be representative of formations A & B.

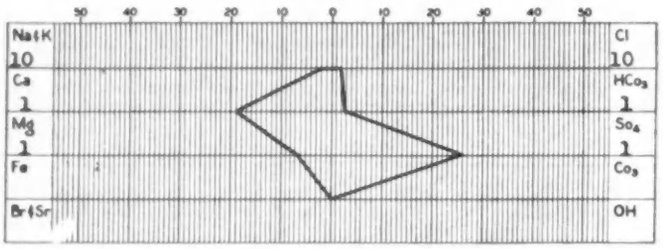
On observing these patterns it is noted that the pattern of the water in question does not match with A or B, and therefore probably is a mixture of the two. We may now calculate various mixtures of waters A & B and plot their patterns. If we assume a mixture of 25 percent of water A and 75 percent of water B we obtain Pattern 1 of Figure 5. Fifty percent of water A and 50 percent of water B give Pattern 2, and 75 percent of water A and 25 percent of water B give Pattern 3. Now if we compare these three patterns with Pattern 4 we see that Pattern 3 which is composed of 75 percent of water A and 25 percent of water B is the same as Pattern No. 4. Therefore the water in question is composed of 75 percent of formation A water and 25 percent of formation B water. With this information at hand the field men could re-squeeze the well and shut off the upper water. If a sample of the drilling fluid is taken ahead of the drill stem test and analyzed, it is possible to determine whether the water in question is formation water, a mixture of formation waters, a mixture of formation water and drilling fluid, or a mixture of all three.

In lenticular formations the different sand bodies as a rule will have different waters although they lie relatively close together within the formation. Figure 6 shows patterns for three waters in the Sundance formation in a Wyoming pool. All three of these sands may be present in some tests within a field. However, some may have lensed out in others. So with water analysis it is possible to tell which sands are present.

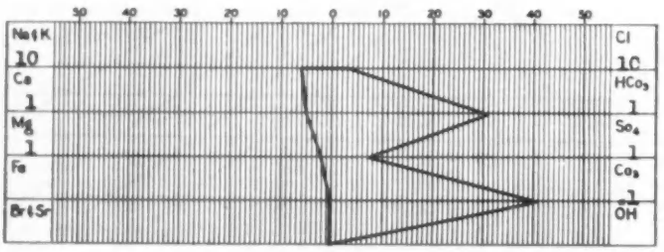
Note also that the waters of the



WATER A

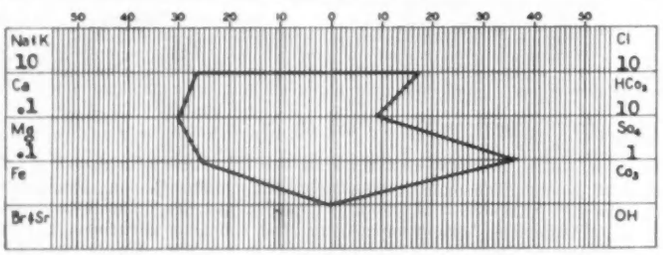


WATER B

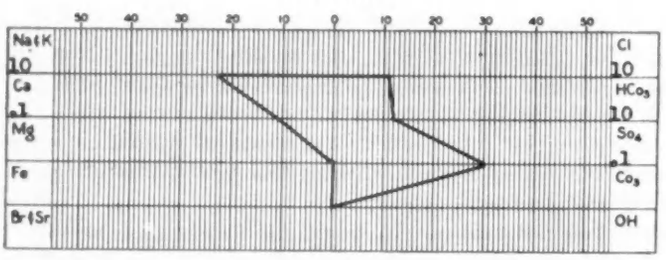


WATER IN QUESTION

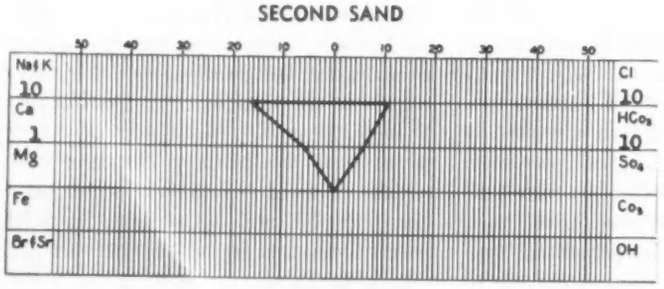
Fig. 4—The pattern system can be used to correlate waters. A water in question is indicated to be a mixture of Waters A and B from formations A and B, respectively.



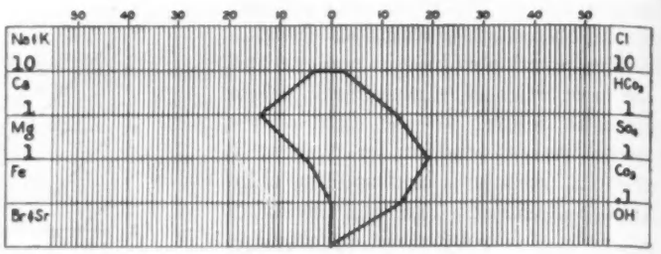
FIRST SAND



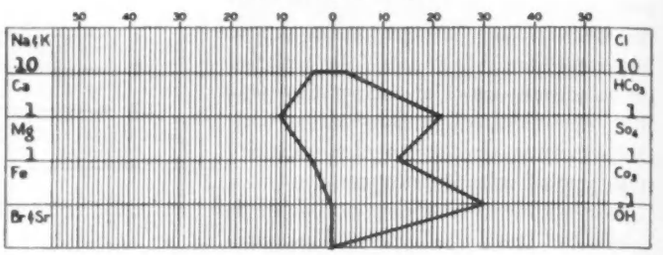
SECOND SAND



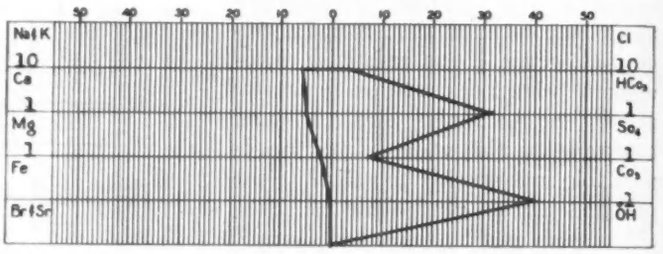
THIRD SAND



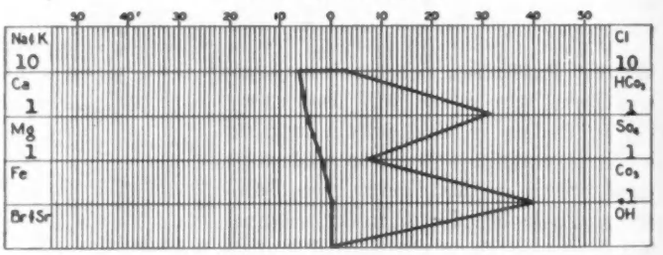
NO. 1—25%A—75%B



NO. 2—50%A—50%B



NO. 3—75%A—25%B



NO. 4—WATER IN QUESTION

Fig. 5—Mixtures of Waters A and B, shown in Figure 4, in different proportions give different patterns. The water in question matches the mixture, which is 75% Formation A water and 25% Formation B water. This information might be of practical value, as by indicating the necessity of re-squeezing a well to shut off upper water in testing a lower formation.

Fig. 6 (left)—Patterns for waters in three lenticular sands in the Sundance formation in a Wyoming Pool. All three sands may be present in some wells, but one or more sands may have lensed out in other wells. Water analyses will tell which sands are present.

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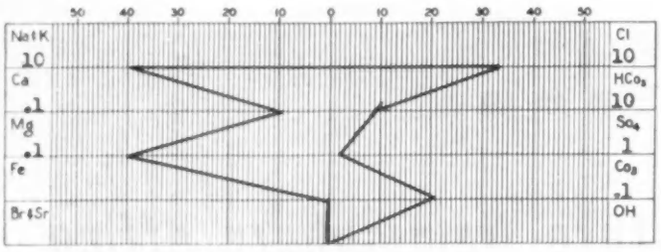
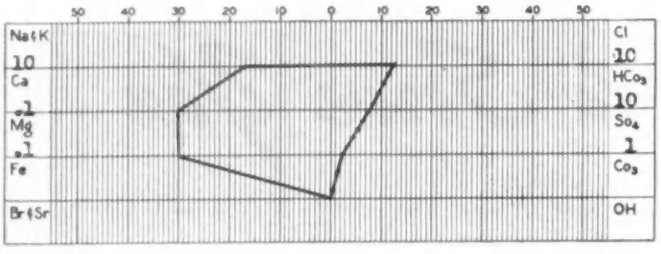
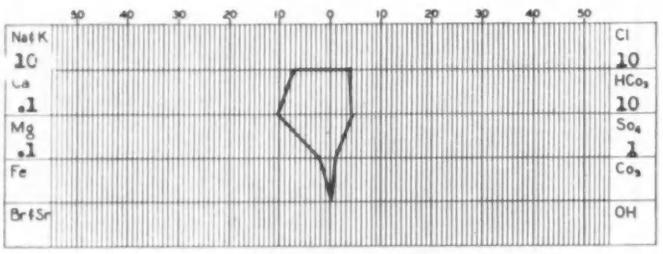


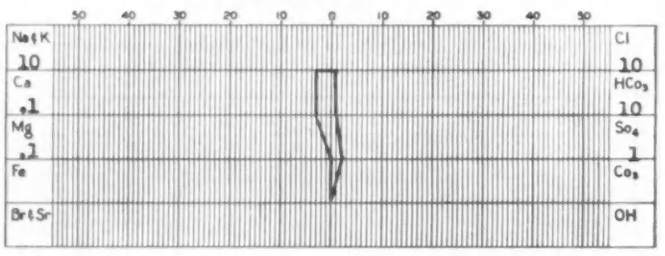
FRONTIER



DAKOTA

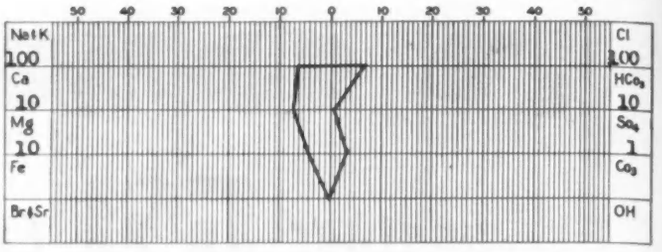


SUNDANCE



TENSLEEP

Fig. 7—Waters from formations in the Rocky Mountain region decrease in concentration with depth. Frontier formation waters, being shallowest, have the highest concentration. The deepest formation, Tensleep, has the least concentrated water.



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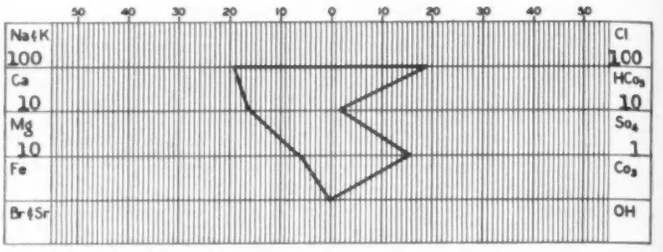

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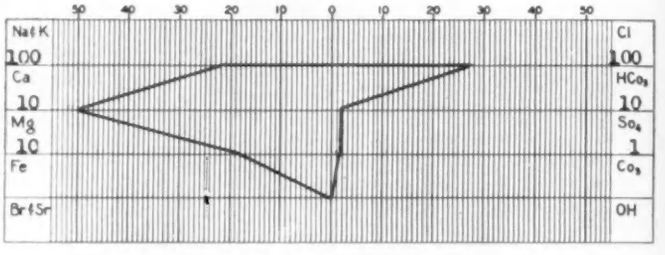

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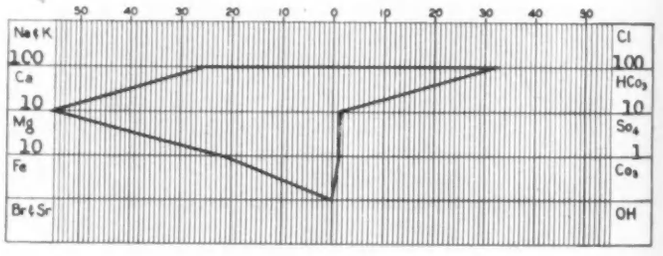

3500 FEET

Fig. 8—In the Mid-Continent region, conditions are the reverse of those in the Rocky Mountain area, as shown in Figure 7. Shallow formations have waters of less concentration, and deeper sands have waters of greater concentration.

Rocky Mountain area decrease in concentration with depth (Figure 7). The Frontier waters being the shallowest have the highest concentration, and the deepest formation (the Tensleep) has the least concentrated water.

The opposite condition exists in the Mid-Continent area. As can be seen on Figure 8, the concentration increases with depth. —**The End**

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[3] Park Jones, "Production Engineering and Reservoir Mechanics." *Oil & Gas Journal*, November (1944) to June (1945).

[4] Henry A. Stiff, Jr., "The Interpretation of Chemical Water Analysis by Means of Patterns." AIME, New Orleans (1950).

About the Author

JOHN F. SAGE started in the oil industry in the engineering department of Prairie Oil & Gas Company, Ranger, Texas, in 1919. He left that company in 1921 to attend Iowa State College, where he studied chemical engineering. In 1925 he returned to the Prairie company at Ranger, and in 1928 he installed a geochemical laboratory in the general office at Independence, Kansas, and was made director of that laboratory. In 1932 the Prairie and Sinclair companies merged, and in 1935 the geochemical laboratory was moved to Tulsa, and Sage remained director of that laboratory until Jan. 1, 1952. At that time the geochemical laboratory and personnel were transferred and made a part of the production research division of Sinclair Research Laboratories, Inc.

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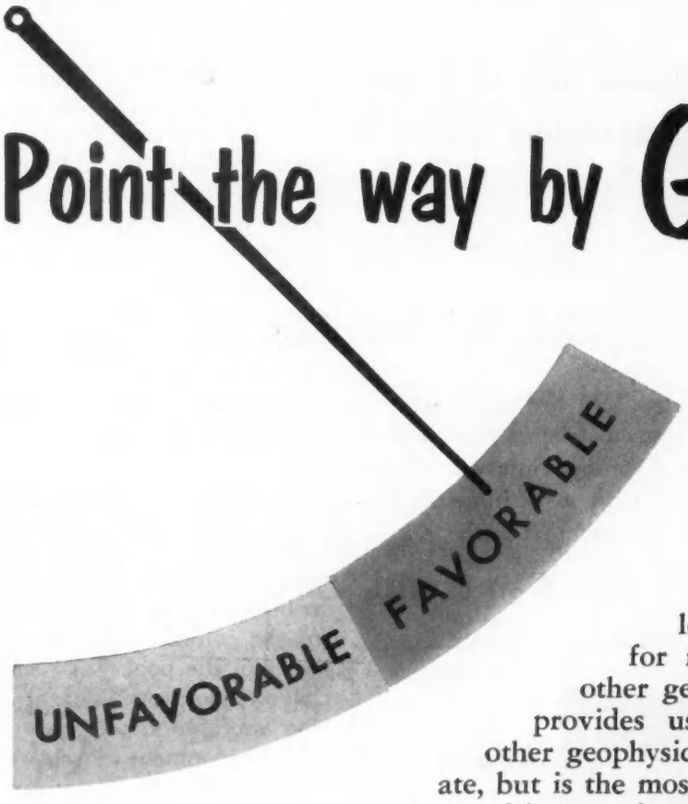

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WORLD-WIDE EXPERIENCE

Deltas Significant in Subsurface Exploration

Many lenticular sand bodies are of deltaic origin and may logically be found paralleling traces of ancient shore lines.

By **DANIEL A. BUSCH,** Consulting Geologist, Tulsa

Axial Trends. The same productive area is shown in Figure 6, which is an isopotential map of the Layton sand, drawn with a contour interval of 100 barrels. This figure serves to illustrate clearly the deltaic nature of a series of distributary channelways of a portion of a prolific Layton Delta. The sinuous axial trends of the distributaries are emphasized by means of long, dashed lines. By referring to Figure 5 it may be seen that similar axial lines can be superimposed, but they are not nearly so sharply substantiated. Such a map as shown in Figure 6 is much more definitive of distributary channel positions than the structure map, Figure 5. An isopotential map of this type explains the anomalous condition of a well of high initial potential being directly offset by another which may be either dry or of low initial potential. Localized structural lows generally occur in inter-channel areas, and are characterized by wells of low productivity.

The initial potential is considered a crude measure of a well's ability to produce. Wells of high initial potential are coincident with thicker sand development and are generally aligned with downstream bulging of structural contours. The initial potential indirectly reflects relative permeability. It might be argued that such a map as shown in Figure 6 is misleading, in that earlier wells will draw down the initial productivity of wells completed at a later date. Other objections might be that variable chokes are used in rating the potentials of the various wells, or that testing periods were not always for 24-hour periods. Many of these variable factors are minimized by the use of a large contour interval. In instances where the range of initial productivity is great, it is wise to employ a geometric, rather than an arithmetic, contour interval. Figure 6 is drawn with an arithmetic contour interval, except for the outside contour line.

About the Author

DANIEL A. BUSCH was graduated from Capital University in 1934 with a B.S. degree in chemistry. He received M.A. and Ph.D. degrees in geology from The Ohio State University in 1936 and 1939 respectively. He taught geology at the University of Pittsburgh from 1938 to 1943. The following year he worked in the Oil and Gas Division of The Pennsylvania Geological Survey. The next 2½ years he was a consultant geologist with Huntley and Huntley in Pittsburgh. In 1946 he became senior research geologist at The Carter Research Laboratory in Tulsa. Three years later he became a staff geologist with The Carter Oil Company. In 1952 he became manager of exploration with Zephyr Drilling Corporation, Tulsa, and resigned recently to become a consulting geologist.

PART 2

Similar Studies. The writer has made similar studies of pools where cumulative production data, by wells, were available for Clinton and Medina sand pools in eastern Ohio. In such instances decline curves were plotted for each well as a basis for determining the leveling-off point in the production decline curve. In those pools so studied the decline curve levels off in from 3 to 3½ years; this was then used as the time interval for plotting cumulative production figures for each well. Although this type of data is much more representative regarding the wells' productive capabilities, the resultant contour map is no more definitive of the distributary channelways than a map of the initial potentials of the same wells in the pool. For such a map to have exploratory value it must point the way for step-out wells early in the development of a pool. The contouring of cumulative data has only historical significance, whereas the initial potential data are useful throughout the development of the pool.

Figure 7 is a comparative series of maps all illustrating different, but related, characteristics of the same sand. It may be readily noted that the structure map is the least informative and the most difficult to analyze. It has little exploratory significance. An isopach of the same sand (Booch) serves to clearly illustrate a series of distributary channel sands which bifurcate in a southeasterly direction. The isopotential map of the same sand is remarkably similar to the isopach, showing the same deltaic distributary system. A comparison of these latter two types of maps shows a direct relationship between sand thickness and high productivity in channel distributaries. Structurally low areas, in some instances, may have comparatively thick sand and high initial productivity, as illustrated in the northeastern portion of Section 20.

Perhaps the most significant aspect of the combination isopach and isopotential map is the fact that they have much greater significance in the early developmental stages of a pool than the structure map of the same

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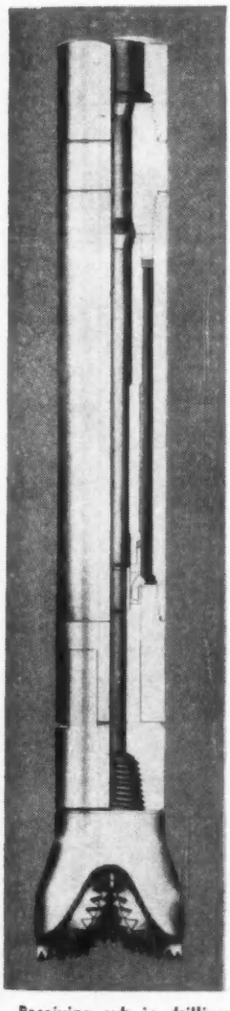

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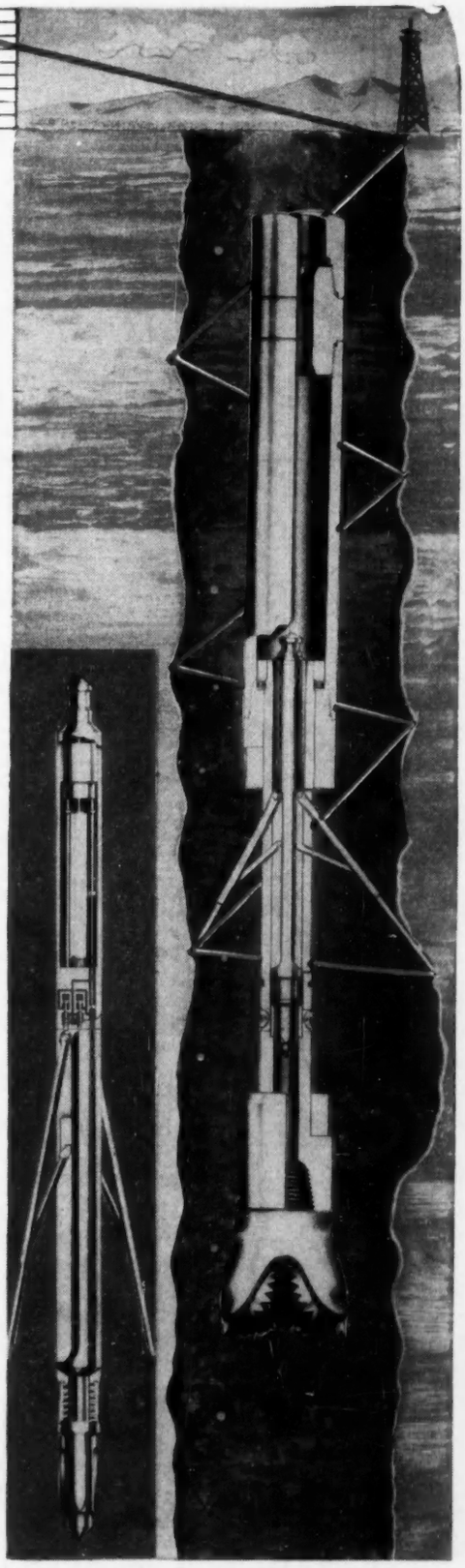

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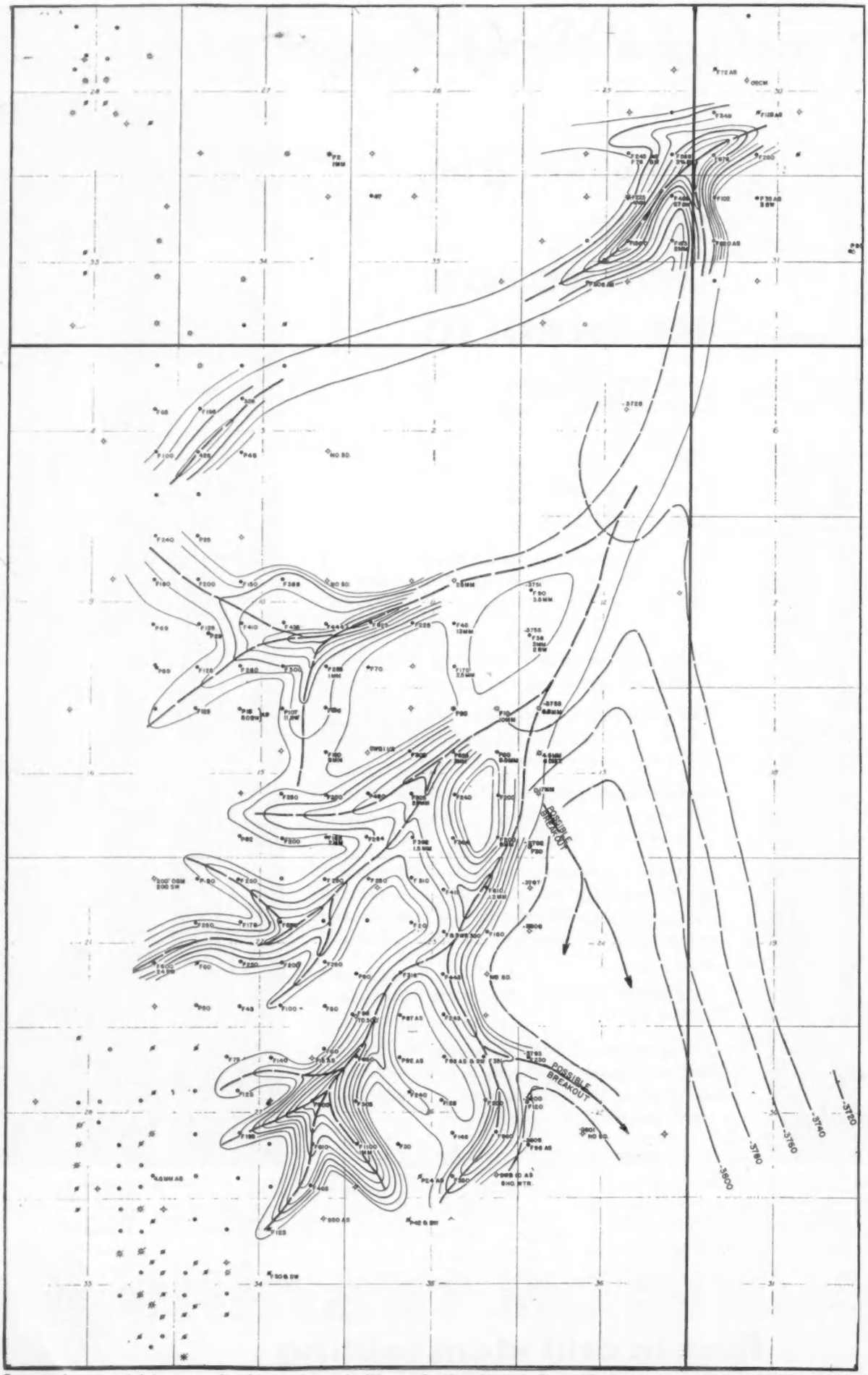
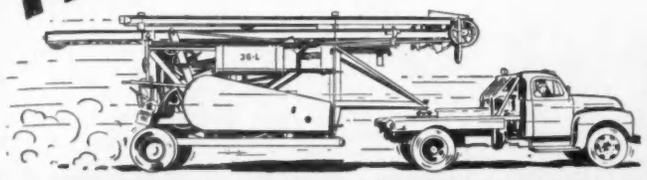


Fig. 6—Layton isopotential in same district as shown in Figure 5 (See Part 1, Page 98, December, 1954, WORLD OIL). Contour interval equals 100 barrels.

Here's Speed That Pays Off



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Quick set-ups and knock-downs increase production, too, because you get more actual drilling time on each job as a result. All-steel telescoping derricks are power raised; folding tubular braces move easily into place; the entire set-up operation takes as little as two or three hours, even with the largest machine.

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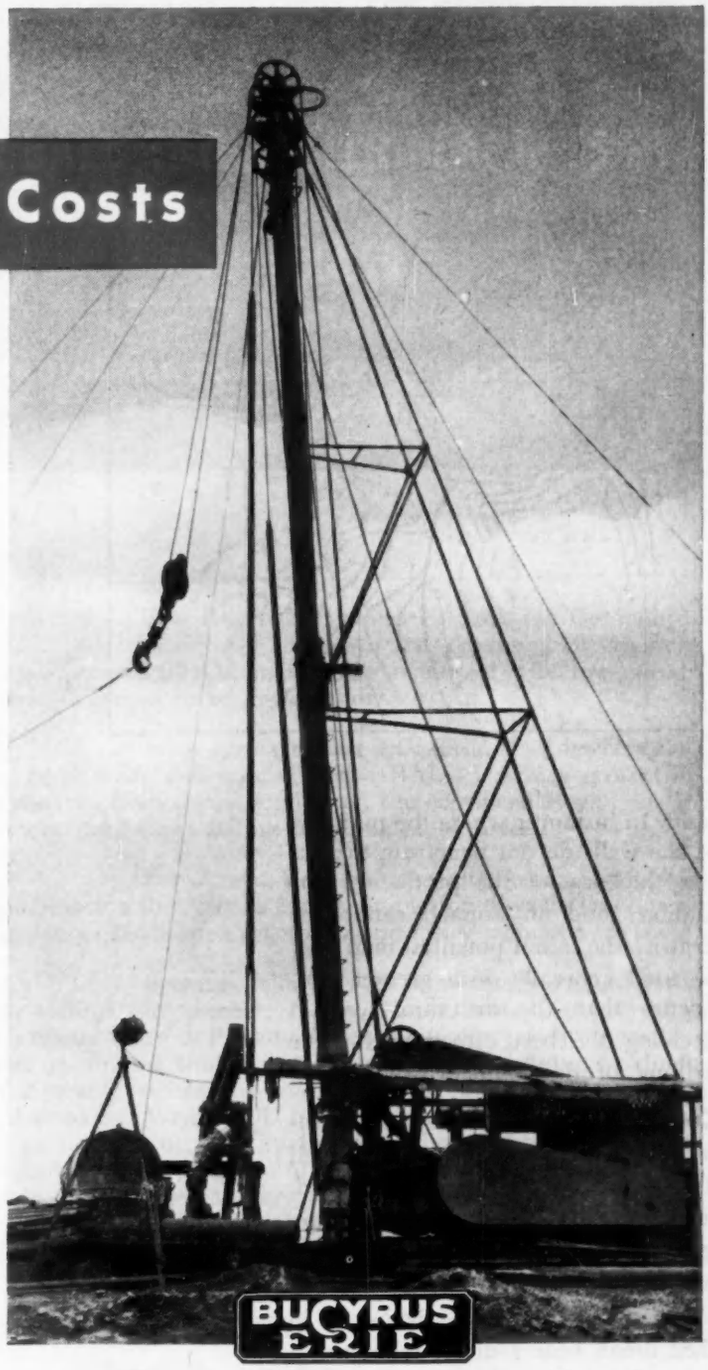
Bucyrus-Erie spudders are sold by exclusive distributors in all principal oil fields. Four models: 48-L swings 6,000 lb. tools, drills to 6,000 ft.; 36-L handles 4,200 lb. tools, drills to 3,500 ft.; 28-L swings 3,000 lb. tools, drills to 2,500 ft.; 60-L tool rating 2,750 lb., depth 1,500 ft. See your distributor for full details. 9S54C



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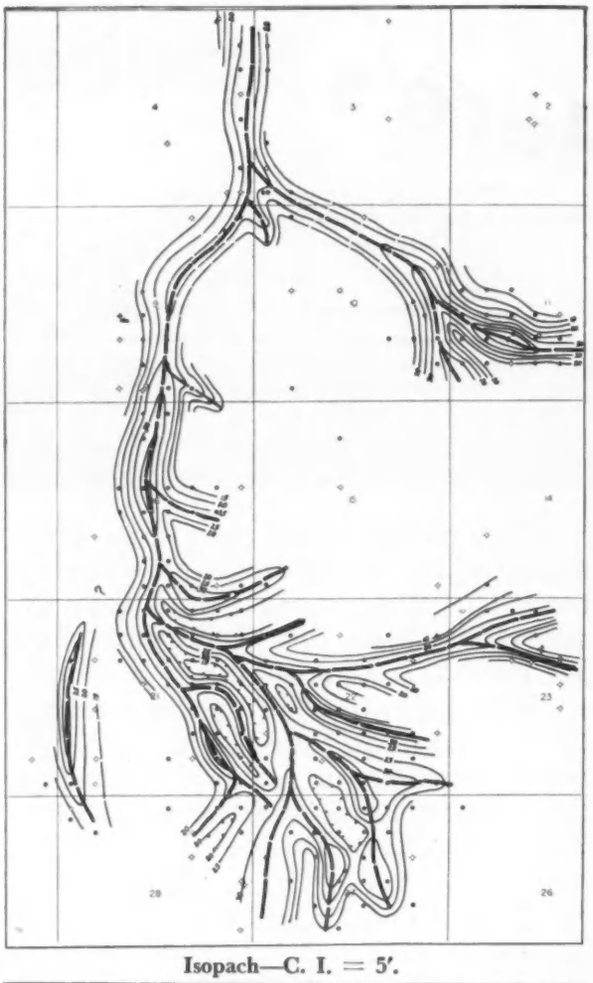
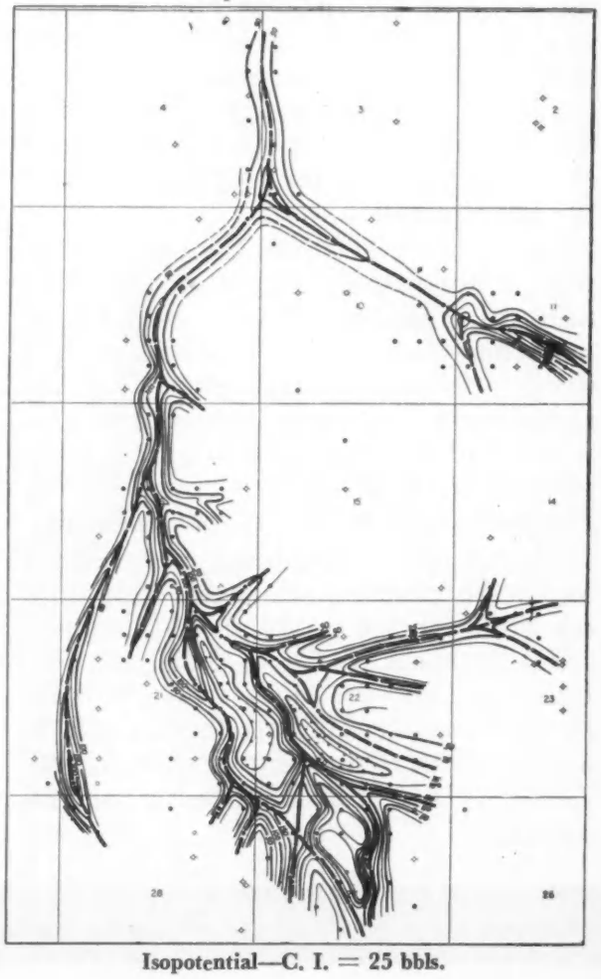
Structure—C. I. = 20′.



Isopach—C. I. = 5′.



Isopotential—C. I. = 25 bbls.

Fig. 7—Booch sand, Hawkins Pool area, T6N, R8E, Hughes County, Oklahoma.

sand. In instances where the majority of the wells do not penetrate the entire thickness of the producing formation (and an isopach cannot be drawn) the initial potential map may be used generally with greater confidence than the structural map in deciding the best directions for the drilling of development wells.

Conclusion. From the several examples discussed and illustrated, as well as numerous examples not included, it is the writer's conviction that many lenticular sands are either deltaic in origin or genetically related to deltas.

Most of such sands, deposited in shelf areas, bear a direct relationship to ancient shoreline positions and trends and do not require turbidity currents as an explanation for their existence. The alignment of lenticular sand deposits, many of them being deltaic in origin, parallel to traces of successive positions of ancient shorelines affords a logical explanation for what generally has been considered an erratic distribution of lenticular sands. —The End.

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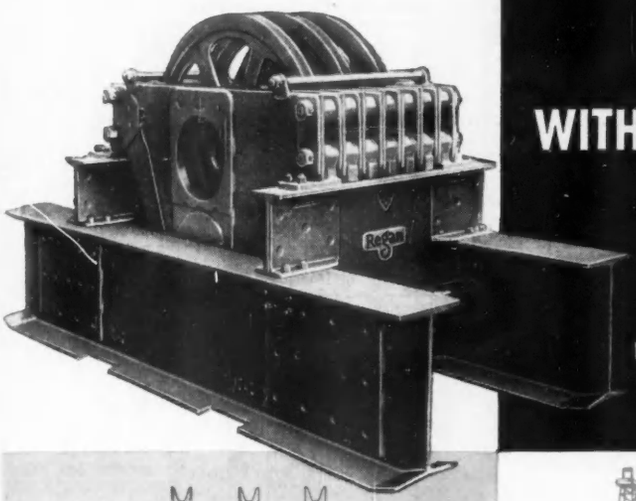

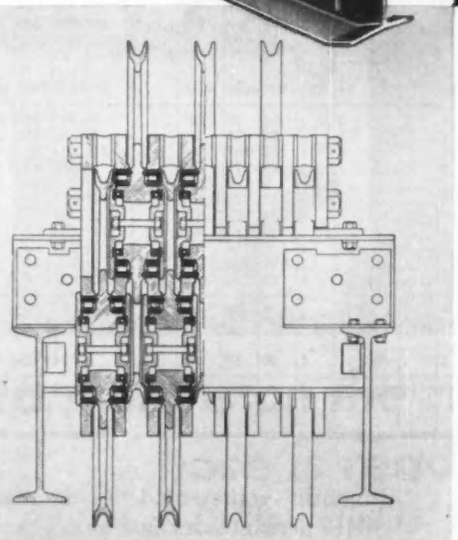

MOUNTING ARRANGEMENT of Aetna radial roller and ball thrust bearings in Regan's AN 55, seven-sheave, 600 ton capacity crown block. Roller bearings have complement of 28—1 ¼" dia. x 1½" long rollers; radial load capacity of 115,700 lbs. @ 10 R.P.M.—38,570 lbs. @ 270 R.P.M. Thrust bearings have laminated phenolic retainers with 28—¾" balls; thrust load capacity of 50,270 lbs. @ 10 R.P.M.—16,750 lbs. @ 270 R.P.M.

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Exploratory Drilling—In November and First Eleven Months 1954-1953

State or District	MONTH OF NOVEMBER, 1954													FIRST ELEVEN MONTHS, 1954																
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Total Productive		Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	11 Mo. 1954	11 Mo. 1953	Wildcats	New Pays	Outposts	11 Mo. 1954	11 Mo. 1953	11 Mo. 1954	11 Mo. 1953
Alabama											5		1	6												58		1	59	75	59	75
Arizona			1							1				1			1							1		8			8	6	9	6
Arkansas	1			1						2	9			11	3		1	4		1	3			12	28	95		4	99	126	111	154
California	4		2	2			2			10	34		4	48	22		6	10		1	5		2	46	75	317		7	324	425	370	500
Colorado	4		3	1			3			11	60		5	76	42	4	17	3		1	6		1	74	43	508		19	527	268	601	311
Florida											1			1	1									1		25			25	31	26	31
Georgia																										8			8	9	8	9
Idaho																										1			1	4	1	4
Illinois	2			2			5			9	54			63	24			30			57			111	74	545			545	430	656	504
Indiana											26			26	9		2							11	38	248			248	341	259	379
Kansas	13		4				1			18	53		2	73	106		27	4		1	6		1	145	159	676		12	688	809	833	968
Kentucky			1							1	7			8	21		1							22	23	51			51	103	73	126
Louisiana	4	1	1	4	7	1	1	1	1	21	43		3	67	32	22	15	45	42	11	11	4	10	192	130	360		22	382	366	574	496
North Louisiana					1	1				2	25			27	6	1	3	7	3	4	4	1	2	31	24	155		4	159	196	190	220
South Louisiana	4	1	1	4	6		1	1	1	19	18		3	40	26	21	12	38	39	7	7	3	8	161	106	205		18	223	170	384	276
Michigan	1									1	20			21	11						1			12	21	195			195	231	207	252
Mississippi											11		1	12	5		1					1		7	27	155		5	160	183	167	210
Missouri																										6			6	10	6	10
Montana			1							1	10			11	6		3	2			2			13	13	94			94	105	107	118
Nebraska	4									4	16		4	24	29		3	1			4			37	25	131		7	138	131	175	156
Nevada															1									1		10			10	8	11	8
New Mexico	2	1	1				1		3	8	13			21	19	2	36	5	2	2	7		4	77	74	148		1	149	128	226	202
North Carolina																														1		1
North Dakota											8			8	2			2			2			6	12	101			101	75	107	97
Ohio																					3		4	7	7	12			12	13	19	20
Oklahoma	4	4	1	1			7	1		18	60		7	85	99	12	17	27	1	1	61	3	3	224	248	643		26	669	645	893	893
Pennsylvania																									1	1			1		1	1
South Dakota											2				1									1		13			13	21	14	21
Tennessee																														1		2
Texas	46	3	10	26	1	1	10	1	2	100	327		6	433	488	69	85	241	50	21	107	14	16	1091	1036	3780		62	3842	3899	4933	4935
Dist. 1 S. Central	1		1	2			3			7	37		1	45	24	2	6	6	1	1	10	2	2	54	32	296		5	301	299	355	331
Dist. 2 Middle Gulf	1		1	1		1			1	5	22			27	6	12	13	7	3	4	3	1	3	52	65	247		4	251	251	303	316
Dist. 3 Upper Gulf	4			5				1		10	37		5	52	21	14	4	61	21	5	2	3	1	132	137	369		35	404	387	536	524
Dist. 4 L. Gulf-S.W.	3	1	2	9	1					16	31			47	23	22	6	55	19	4	2	6	2	139	177	338		7	345	440	484	617
Dist. 5 E. Central											18			18	2		1	1			1			5	9	135			135	104	140	113
Dist. 6 Northeast											17			17	3	4	1	3	2					13	24	151		2	153	136	166	160
Dist. 7-B N. Cent.	15		3	2			2			22	69			91	155	1	27	24			12		2	221	221	828		2	830	888	1051	1109
Dist. 7-C W. Cent.	4		1	1					1	7	24			31	46	4	10	14	1	2	9		3	89	84	325		3	328	318	417	402
Dist. 8 West	7	1	2	4			3			17	15			32	87	3	5	36	2	3	47	1	1	185	116	331		2	333	351	518	467
Dist. 9 North	11			2			2			15	56			71	116	4	4	32		1	20		1	178	168	707		2	709	715	887	883
Dist. 10 Panhandle		1								1	1			2	5	3	8	2	1	1	1	1	1	23	3	53			53	10	76	13
Utah	1									1	5		1	7	3		2							5	13	39		1	40	42	45	55
Washington											1			1												1			1		1	
West Virginia																										2			2		2	
Wyoming	6		2				1		1	10	19			29	57		7	7	1	1	6		1	80	39	194			194	120	274	159
Total U. S.	92	9	27	37	8	2	31	3	7	216	784		34	1034	981	109	224	381	96	40	281	22	42	2176	2087	8425		167	8592	8606	10,768	10,693

Exploration Ahead of 1953

Race for all-time peak promises to be close.

By CECIL W. SMITH, WORLD OIL Staff

EXPLORATORY WELL completions this year have varied only slightly from last year's all-time high activity, and at the end of 11 months only 75 wells separated the two periods with current operations holding the advantage. A touch-and-go race for leadership is clearly indicated for the final month.

So far this year, U. S. industry has completed 10,768 exploratory tests, and that figures to be a 0.7 percent lead over the 10,693 recorded in the comparable period of 1953. Numerically, this year's exploration has been considerably more successful than just the increase of total wells over last year would indicate. Total tests numbering 0.7 percent more accounted for 4.3 percent more producers.

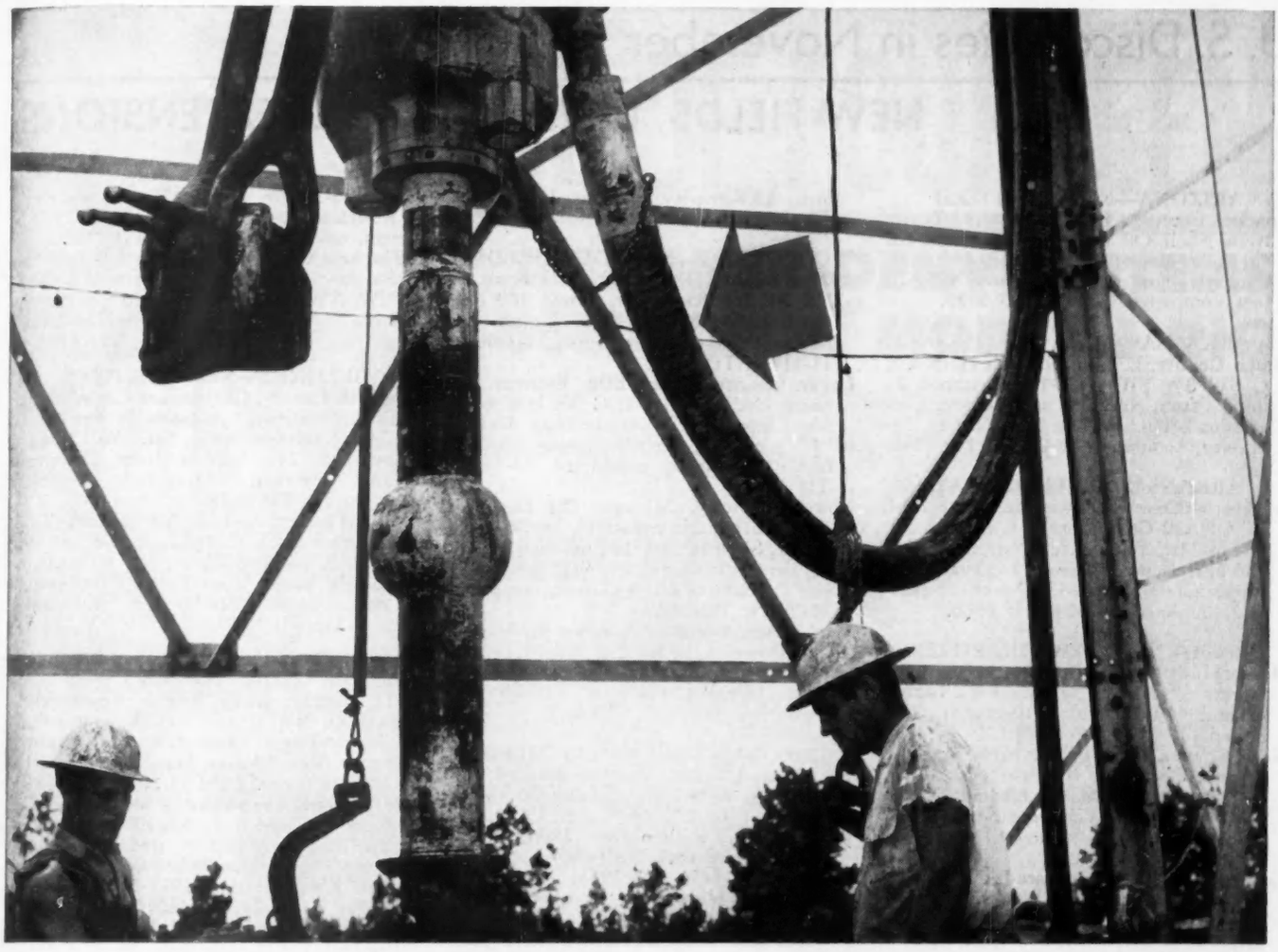
An even better and more encouraging comparison shows that new producing pools actually registered a gain of 6.9 percent over last year's discoveries. The comparison of producers made in the preceding paragraph included major extensions to established fields, which this year have declined, while the comparison just made took account of all new oil, distillate, and gas fields and new pay horizons in existing fields.

Oil discoveries totaled 1362 this year for a gain of 3.8 percent over the 1312 new pools uncovered a year earlier. This year's finds included 981 new oil fields and 381 new oil pays.

Distillate finds totalling 205 in 11 months represented an increase of 44.4 percent over last year's, and gas discoveries amounting to 264 just barely beat out last year's 259 by 1.9 percent.

Summary of Results of Exploratory Drilling

ITEM	Nov., 1954	Oct., 1954	ELEVEN MONTHS January-November 1954	1953	Percent Diff.
Oil Discoveries	129	119	1362	1312	+ 3.8
New Fields	92	73	981	960	+ 2.2
New Pays	37	46	381	352	+ 8.2
Distillate Discoveries	17	13	205	142	+ 44.4
New Fields	9	4	109	87	+ 25.3
New Pays	8	9	96	55	+ 74.5
Gas Discoveries	29	19	264	259	+ 1.9
New Fields	27	16	224	213	+ 5.2
New Pays	2	3	40	46	— 13.0
Total Discoveries	175	151	1831	1713	+ 6.9
Extension to Fields	41	45	345	374	— 7.8
Oil Fields	31	34	281	301	— 6.6
Distillate Fields	3	3	22	26	— 15.4
Gas Fields	7	8	42	47	— 10.6
Total Prod. Tests	216	196	2176	2087	+ 4.3
Dry Holes	818	776	8592	8606	— 0.2
Wildcats	784	732	8425	8477	— 0.6
New Pays				1	
Outposts	34	44	167	128	+ 30.5
Total Expl'tory Tests	1034	972	10768	10693	+ 0.7
Percent Productive	20.9	20.2	20.2	19.5	.....
Percent Dry	79.1	79.8	79.8	80.5	.....



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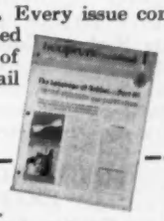

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NEW FIELDS, NEW PAYS AND EXTENSIONS

ARIZONA—NEW GAS FIELD

Apache County, East Boundary Buttes Area. Shell Oil Co.'s Navajo 1, SE SE 6-41n-29, ungaged from Hermosa sand, Pennsylvanian 4884-4944 and 4963-76 feet, completed 4-18-54, TD 6490.

ARKANSAS—NEW OIL FIELD

Union County. E. G. Bradham's Horton 1, C SW SW SW 1-18s-15w, pumped 21 barrels from Nacatoch sand, Upper Cretaceous 2160-2264 and 2264-66 feet, 32-gravity, completed 10-21-54, TD 2266.

ARKANSAS—NEW OIL PAY

LaFayette County, Lewisville, West field. W & S Oil Co.'s Wheelis 1, E½ SE NE 16-16s-24w, pumped 20 barrels oil and 180 barrels water from Tuscaloosa lime, Upper Cretaceous 2845-47 feet, 22-gravity, completed 11-5-54, TD 2968.

CALIFORNIA—NEW OIL FIELDS

Humboldt County. Brookline Oil Co.'s Caesar 1, in 15-1s-2w, pumped 2 barrels oil and 4 barrels water. 40-gravity, completed 11-12-54, TD 2873.

Kern County, Mount Poso Area. Bradford Bishop, Operator's Vedder 1, in 20-27s-28e, pumped 10 barrels oil and 57 barrels water from Vedder sand, Miocene 2170-87 feet, 16.3-gravity, completed 11-22-54, TD 2187.

Los Angeles County, Cascade-Aliso Area. C. W. Teater's Teater-Wadley 1, in 25-3n-16w, pumped 150 barrels from Saugus sand, 2530-2765 feet, 22.6-gravity, completed 10-26-54, TD 2766.

Ventura County, Tapo Canyon, North field. Union Oil Co.'s Simi 27, in 1-3n-18w, pumped 6 barrels oil and 1 barrel water from 1885-2047 feet, 16.5-gravity, completed 11-17-54, TD 2047.

CALIFORNIA—NEW GAS FIELDS

Butte County, Llano Seco area. Humble Oil & Refining Co.'s Parrott Investment Co. 2, in 4-19n-1w, flowed 4.0 million from 3225-38 and 3280-3300 feet, ⅜-inch, completed 11-6-54, TD 6700.

Colusa County, North Colusa area. Humble's A. Steidlmayer et al 3, in 3-15n-1w, flowed 1.5 million from 1378-1415 feet, ½-inch, completed 10-27-54, TD 2093.

CALIFORNIA—NEW OIL PAYS

Los Angeles County, Beverly field. Universal Consolidated Oil Co.'s 20th Century Fox 1, in 25-1s-15w, flowed 525 barrels, 15/64-inch, 24-gravity, completed 1-15-54, TD 8562.

Santa Barbara County, Cat Canyon field. M J M & M Oil Co.'s Thomas 88-X, in 15-9n-33w, pumped 13 barrels from Basal Sisquoc sand, 4779-4824 feet, 14-gravity, completed 11-14-54, TD 4860.

CALIFORNIA—OIL FIELD EXTENSIONS

Orange County, Sunset Beach field. Atlantic Oil Co.'s Ramser 1, in 29-5s-11w, ⅝-mile southwest extension, flowed 478 barrels from Lower Aston sand, 6100-6400 feet, 18/64-inch, 29.4-gravity, completed 11-13-54, TD 6650.

Ventura County, Rincon field. General Petroleum Corp's Ferguson 101, in 7-3n-24w, ½-mile west extension, flowed 2 barrels from 7018-9690 feet, 20/64-inch, 25.8-gravity, completed 11-29-54, TD 9702.

COLORADO—NEW OIL FIELDS

Adams County. Ryan Oil Co.'s Knox 1, NE NE NE 35-1s-59w, flowed 480 barrels from Dakota "D" sand, Upper Cretaceous 6161-67 feet, open, completed 11-11-54, TD 6318.

Logan County, Frasco field. Frontier Refining Co.'s Fasco 2-1, C NE NW 4-7n-55w, flowed 120 barrels from Dakota "J" sand, Upper Cretaceous 5535-39 feet, 18/64-inch, completed 11-15-54, TD 5539.

Morgan County. Midwest Oil Corp. & Rocky Mountain Standard, Inc.'s O. G. Poe 1, SW SW NW 12-3n-59w, pumped 10 barrels from Dakota "D" sand, Upper Cretaceous 5840-45 feet, completed 10-20-54, TD 5953.

Washington County. Vaughey & Vaughey's Downing 1, NE NE NE 34-1s-56w, pumped 148 barrels from Dakota "D" sand, Upper Cretaceous 5060-66 feet, completed 11-24-54, TD 5250.

COLORADO—NEW GAS FIELDS

La Plata County, Bondad field. U. S. Smelting, Refining & Mining Co.'s Arvil Brown 1-A, E½ W½ SE 15-33n-9w, flowed 13.7 million from Dakota sand, Upper Cretaceous 7840-7965 feet, completed 11-12-54, TD 7965.

South Red Mesa area. Southern Union Gas Co.'s Birbeth 1, SW NE NE 22-32n-11w, flowed 2.1 million from Mesaverde sand, Upper Cretaceous 5295-5650 feet, completed 11-26-54, TD 5650.

Morgan County. Braden Hoover & Kejr's Glenn 1-B, NW NW SE 9-1n-57w, ungaged from Dakota "J" sand, Upper Cretaceous 5456-58 feet, completed 10-4-54, TD 5492.

COLORADO—NEW OIL PAY

Adams County, Rosener field. S. D. Johnson & Cosden Petroleum Co.'s Johnson-Rosener 1, SE SE SW 12-1s-59w, pumped 180 barrels from Dakota "D" sand, Upper Cretaceous 6120-24 and 6125-29 feet, completed 11-11-54, TD 6282.

COLORADO—OIL FIELD EXTENSIONS

Morgan County, Masters field. Cimarron Western Drilling Co.'s Cooke 1, in 30-5n-60w, 1-mile east extension, flowed 75 barrels from Dakota "D" sand, Upper Cretaceous 6486-90 feet, 19/64-inch, completed 11-1-54, TD 6572.

Weld County, Battle Canyon field. Stanolind O&G Co.'s F. T. Vance 1, C NW SW 22-11n-56w, pumped 302 barrels from Dakota "J" sand, Upper Cretaceous 6055-67 feet, completed 11-26-54, TD 6125.

Roggen, Southwest field. Earl F. Siler's George Zimbelman 1, NE NW SW 23-2n-63w, ½-mile southeast extension, flowed 190 barrels from Dakota "D" sand, Upper Cretaceous 7019-40 feet, 12/64-inch, completed 11-20-54, TD 7148.

ILLINOIS—NEW OIL FIELDS

Coles County, Cooke Mills, East field. H. C. Sanders' B. Parker 1, SW NW NE 25-14n-7e, pumped 54 barrels from Rosiclare sand, Mississippian 1782-85 feet, completed 11-23-54, TD 1789.

Effingham County, Elliottstown, East field. Partlow & Cochonour's French 1, NW NW NW 34-7n-7e, pumped 10 barrels from Cypress sand, Mississippian 2486-91 feet, completed 11-9-54, TD 2493.

ILLINOIS—NEW OIL PAYS

Franklin County, Christopher Consolidated field. National Associated Petroleum Co.'s Lindsay-Giles 1, SW SW 13-6s-1e, pumped 241 barrels from Devonian lime, Devonian 4432-79 feet, completed 11-30-54, TD 4479.

White County, Carmi, North field. Gulf Refining Co.'s H. Gates 2, NE NE SE 4-5s-9e, pumped 52 barrels oil and 84 barrels water from Paint Creek sand, Mississippian 3078-90 feet, completed 11-9-54, TD 3236.

ILLINOIS—OIL FIELD EXTENSIONS

Christian County, Edinburg, West field. H. Herring et al's E. Pickering et al 1, NE NE NW 19-14n-3w, 1¼-mile extension, pumped 7 barrels oil and 1 barrel water from Silurian lime, Silurian 1803-1808 feet, completed 11-30-54, TD 1846.

Mt. Auburn Consolidated field. Ohio Oil Co.'s H. Forden 1, NE SE SE 24-15n-2w, ¾-mile extension, pumped 32 barrels oil and 35 barrels water from Silurian lime, Silurian 1921-28 feet, completed 11-16-54, TD 1976.

Mt. Auburn field. R. H. Proctor's C. W. Watts, Sr. 1, NE SW SE 9-15n-1w, ¾-mile extension, pumped 85 barrels from Silurian lime, Silurian 1885-1900 feet, completed 11-16-54, TD 1913.

Macon County, Decatur field. M. H. Richardson's B. Trimby 1, NE SW NE 32-17n-2e, ½-mile extension, pumped 70 barrels oil and 2 barrels water from Silurian lime, Silurian 1985-87 feet, completed 11-9-54, TD 2034.

Wayne County, Mill Shoals field. W. Misener Drilling Co.'s H. L. Topping 1, NE NE SW 36-2s-7e, 1-mile extension, Old Well Worked Over, pumped 24 barrels oil and 24 barrels water from Rosiclare sand, Mississippian 3407-45 feet, completed 11-30-54, TD 3560.

KANSAS—NEW OIL FIELDS

Barber County, Medicine Lodge, North field. Anschutz Drilling Co.'s Lonker 1, NE NE NE 25-32s-13w, pumped 161 barrels from Mississippi dolomite, Mississippian 4472-93 feet, TD 4971.

Barton County, Bissell Point field. Schermerhorn Oil Co.'s Bissell 1, NW SE SE 10-19s-13w, pumped 172 barrels from Lansing lime, Pennsylvanian 3276-3302 feet, TD 3520.

Sandrock, Southeast field. Rocket Drilling Co.'s McDonald 1, SE SW NE 34-20s-13w, pumped 50 barrels from Lansing lime, Pennsylvanian 3266-3329 feet, TD 3592.

Cowley County. L. C. Smitherman's Henderson 1, NW SW SE 34-31s-6e, pumped 17 barrels from Layton sand, Pennsylvanian 2214-22 feet, TD 2222.

Edwards County. Gramehart-Miller's Sturgeon 1, SE SE NW 33-26s-18w, pumped 35 barrels from Viola lime, Ordovician 4721-26 feet, TD 4920.

Graham County, Holley field. Empire

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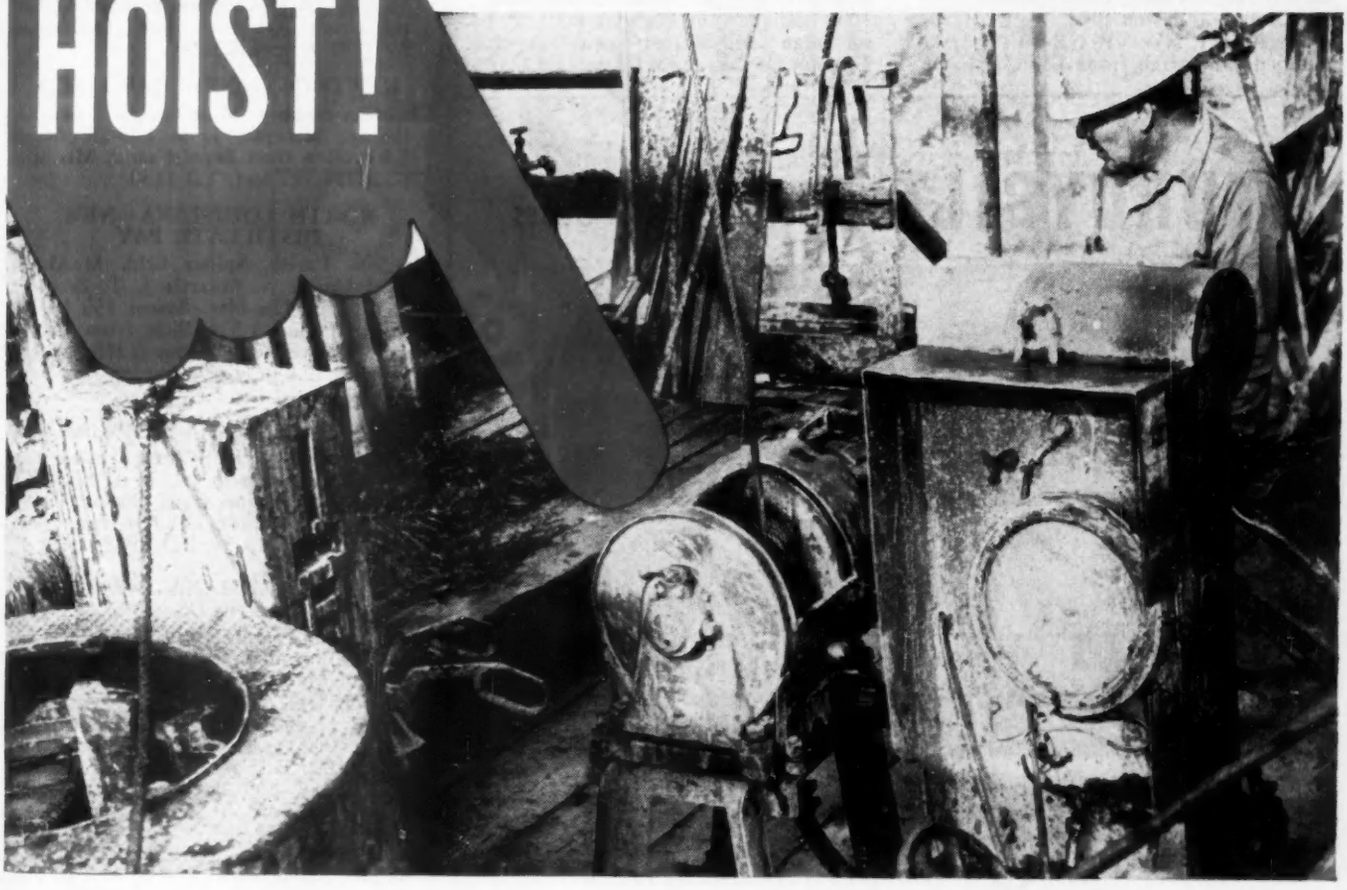

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Drilling Co.'s Keith 1, SW SW SW 3-9s-24w, potentialed 1736 barrels from Lansing lime, Pennsylvanian 3900-06 feet, TD 3985.

Prairie Glen field. Petroleum, Inc.'s McCall 1-B, NE NE SW 25-10s-23w, pumped 200 barrels oil and 163 barrels water from Lansing lime, Pennsylvanian 3596-3600 feet, TD 4145.

Pawnee County. Hilton Drilling Co. & Sunray Oil Corp.'s Fergus 1-B, NW NW SW 16-23s-17w, pumped 36 barrels from Mississippi lime, Mississippian 4254-62 feet, TD 4375.

Pratt County. Anschutz Drilling Co.'s Tatlock 1, NE NE NW 28-26s-15w, pumped 455 barrels from Lansing lime, Pennsylvanian 3925-29 feet, TD 4700.

Scott County, Grigston field. W. L. Hartman's Rush 1, NW NW NE 10-19s-31w, pumped 153 barrels from Arbuckle lime, Ordovician 5050-54 feet, TD 5078.

Stafford County. Harms-Burt Drilling Co.'s Radke 1, NE SW SE 24-23s-14w, pumped 161 barrels from Lansing lime, Pennsylvanian 3676-80 feet, TD 4065.

Sumner County. Crisswell Drilling Co.'s Work 1, SW SW SW 28-34s-2e, pumped 25 barrels from Mississippi lime, Mississippian 3502-10 feet, TD 3510.

Unnamed field. Time Petroleum Co. & McClure's Gerberding 1, SE NE NE 6-34s-4w, pumped 25 barrels oil and 100 barrels water from Simpson sand, Ordovician 4712-23 feet, TD 4723.

KANSAS—NEW GAS FIELDS

Barber County. Armer Drilling Co.'s Fitzgerald 1, SE SE SE 7-33s-11w, flowed 10.9 million from Douglas sand, Pennsylvanian 3648-56 feet, open, TD 4500.

Unnamed field. Aurora Gasoline Co. & Barbour Drilling Co.'s Rathgeber 1, C NE SE 31-34s-12w, flowed 13.5 million from Mississippi lime, Mississippian 4838-43 feet, open, TD 5566.

Unnamed field. Purcell & Mull's Barkley 1, SE SE NE 10-32s-14w, flowed 12.4 million from Viola lime, Ordovician 4670-80 feet, TD 4927.

Kingman County, Zenda field. Rupp-Ferguson Oil Co.'s Hartshorn 1, SE SW SE 36-29s-9w, flowed 7.6 million from Mississippi sand, Mississippian 4161-70 feet, TD 4700.

KANSAS—OIL FIELD EXTENSION

Barton County, Rick field. Derby Oil Co.'s Johanning 1, NE NW NE 13-19s-11w, ½-mile south extension, pumped 44 barrels from Arbuckle lime, Ordovician 3367-69 feet, TD 3380.

KENTUCKY—NEW GAS FIELD

Christian County. Mike Callas et al's Littlepage Minerals 1, in 1-G-26, flowed 6.0 million from Benoist sand, Mississippian 757-797 feet, TD 1150.

NORTH LOUISIANA—NEW DISTILLATE PAY

De Soto Parish, Spider field. McAlester Fuel Co. & S. Stuart's J. T. Scurlock A-1, in 22-12n-14w, flowed 1½ barrels distillate and 1.5 million from Paluxy sand, Lower Cretaceous 2946-64 feet, ¼-inch 59.8-gravity, completed 11-2-54, TD 2992.

NORTH LOUISIANA—NEW GAS PAY

Caddo Parish, Bethany field. Union Producing Co.'s Querbes 1, in 17-16n-16w, flowed 7.0 million from Cotton Valley "D" sand, Jurassic 8535-53 feet, open, completed 11-15-54, TD 8923.

SOUTH LOUISIANA—NEW OIL FIELDS

Plaquemines Parish, Main Pass-Block 67. The California Co.'s State Lease 2557-1, Gulf of Mexico, flowed 138 barrels from 6815-33 feet, 8/64-inch, 27-gravity, completed 11-29-54, TD 8015.

South Pass area. Shell Oil Co.'s State Lease 1007 B-1, Block 23, Gulf of Mexico, flowed 200 barrels from 7350-60 feet, 11/64-inch, 31.9-gravity, completed 11-6-54, TD 10,950.

West Delta area. Continental Oil Co.'s State Lease 979-6, Block 54, Gulf of Mexico, flowed 242 barrels from 12,163-169 feet, 9/64-inch, 47.8-gravity, completed 11-1-54, TD 14,625.

St. Martin Parish. Humble's R. H. Goodrich et al K-1, in 30-14s-12e, flowed 105 barrels from 2124-30 feet, 3/16-inch, 26.2-gravity, completed 11-1-54, TD 12,556.

SOUTH LOUISIANA—NEW DISTILLATE FIELD

Assumption Parish. Cities Production Co.-Delhi Oil Co.'s Brownell-Kidd Lumber Co. B-1, in 23-12s-12e, flowed 222 barrels distillate and 5.4 million from 13,550-14,237 feet, 15/64-inch, completed 10-31-54, TD 14,302.

SOUTH LOUISIANA—NEW GAS FIELD

Calcasieu Parish. Douglas Whitaker's W. Walker 1, in 29-10s-6w, ungaged from 10,710-720 feet, completed 11-13-54, TD 10,800.

SOUTH LOUISIANA—NEW OIL PAYS

Cameron Parish, Big Lake field. Stanolind O&G Co.'s Gardiner Estate 1, in 7-12s-9w, flowed 552 barrels from Lower Mio-

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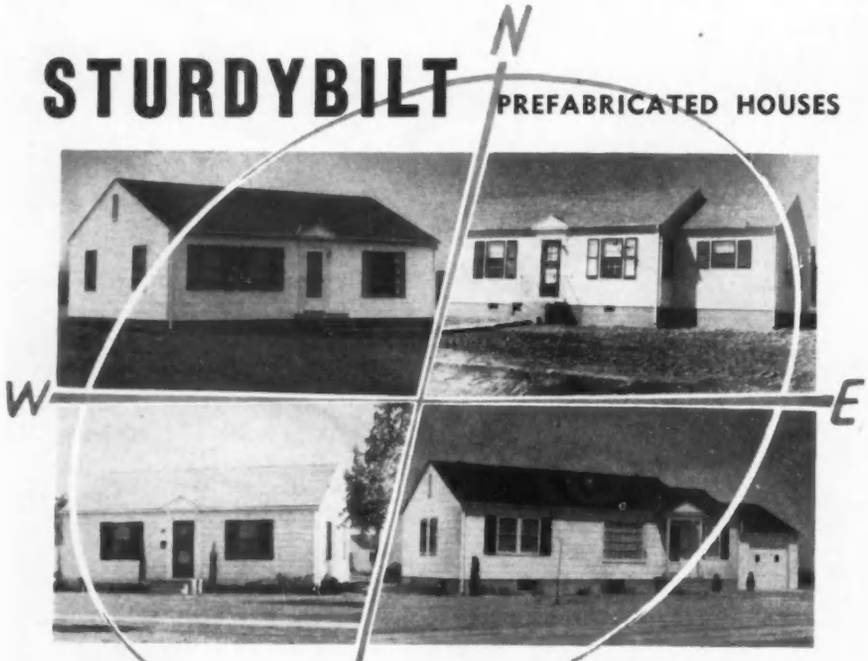

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cene 13,586-600 feet, 12/64-inch, 31.7-gravity, completed 11-19-54, TD 13,975.

Jefferson Parish, Grande Isle-Block 18. Humble's State Lease 979 E-4, Gulf of Mexico, flowed 302 barrels from 9824-35 feet, ⅛-inch, 38.4-gravity, completed 11-23-54, TD 9967.

Plaquemines Parish, Venice field. Tide Water Associated Oil Co.'s Manhattan Land & Fruit Co. E-1, in 22-21s-30e, flowed 265 barrels from 13,714-722 and 13,742-760 feet, 11/64-inch, 37-gravity, completed 11-20-54, TD 15,665.

St. Mary Parish, Eugene Island-Block 126. Magnolia Petroleum Co.'s State Lease 691 H-2, Block 119, Gulf of Mexico, flowed 320 barrels from 6922-35 feet, 11/64-inch, 38.4-gravity, and 367 barrels from 7130-50 feet, 11/64-inch, 38.6-gravity, completed 11-10-54, TD 7434.

SOUTH LOUISIANA—NEW DISTILLATE PAYS

Acadia Parish, Rayne field. Continental Oil Co.'s Dumas Cormier et ux 1, 3-9s-2e, flowed 267 barrels distillate and 4.7 million from 13,942-980 feet, 17/64-inch, 50-gravity, completed 11-1-54, TD 14,025.

Calcasieu Parish, Pine Ridge field. W. T. Burton's Mrs. E. B. Lawton et al 1, in 27-10s-11w, flowed 48 barrels distillate and 1.3 million from 9877-89 feet, 6/64-inch, 49-gravity, completed 11-16-54, TD 9950.

Cameron Parish, Crab Lake field. Forest Oil Corp.'s Dr. M. O. Miller 5, in 20-15s-5w, flowed 30 barrels distillate and 22.0 million from 11,865-880 feet, 10/64-inch, 37.5-gravity, completed 11-1-54, TD 10,305.

Iberia Parish, Eugene Island-Block 110. Magnolia's State Lease 680 F-2, Block 88, Gulf of Mexico, Old Well Drilled Deeper, flowed 50 barrels distillate and 2.9 million from 9690-9700 and 9705-10 feet, 16/64-inch, 53.3-gravity, completed 11-1-54, TD 10,305.

St. Martin Parish, Bayou Long field. Continental's Jeanerette Lbr. & Sh. Co. B-3, in 10-13s-11e, flowed 52 barrels distillate and 3.2 million from "K" sand, Miocene 12,112-148 feet, 12/64-inch, 46.8-gravity, completed 10-31-54, TD 12,839.

St. Mary Parish, Patterson field. Southern Natural Gas Co.'s Zenor 2, in 42-15s-11e, flowed 156 barrels distillate and 5.3 million from 13,266-280 feet, 14/64-inch, 44.2-gravity, completed 11-5-54, TD 13,501.

SOUTH LOUISIANA—OIL FIELD EXTENSION

Cameron Parish, Black Bayou field. John W. Mecom's R. A. Moore 1, in 18-12s-12w, ¾-mile west extension, flowed 120 barrels from Marginulina sand, Oligocene 7439-49 feet, 10/64-inch, 41.6-gravity, completed 11-6-54, TD 8138.

SOUTH LOUISIANA—DISTILLATE FIELD EXTENSION

Calcasieu Parish, Bell City field. Louis J. Roussel's Gilbert Fontenot et al 1, NE 16-11s-6w, ½-mile west extension, ungaged from Lower Miocene sand 10,920-956 feet, completed 10-15-54, TD 11,870.

SOUTH LOUISIANA—GAS FIELD EXTENSION

St. Martin Parish, Bayou Bouillion field. Sohio-Tidewater & Welch Estates Lucie Martin et al 1, in 14-9s-8e, 1-mile west extension, ungaged from Upper Miocene 10,200-230 feet, completed 11-25-54, TD 10,635.

MICHIGAN—NEW OIL FIELD

Van Buren County. B. W. Yasdick, Trustee's Plott 1, SW SE NE 32-4s-14w, Decatur Township, pumped 7 barrels from Traverse lime, Devonian 966-969 feet, TD 969.

MONTANA—NEW GAS FIELD

Toole County. Pacific Western Oil Co.'s Rankin 1, SE NE SW 19-36n-3w, flowed 0.7 million from Upper Cut Bank sand, Lower Cretaceous 2469-2575 feet, open, completed 10-30-54, TD 2575.

NEBRASKA—NEW OIL FIELDS

Banner County. Rex Petroleum Corp.'s Johnson Estate 1, C SW NE 27-18n-53w, pumped 100 barrels from Dakota "J" sand, Upper Cretaceous 5462-71 feet, completed 11-10-54, TD 5473.

Cheyenne County. Harper-Turner & Dunn & Boreing's Nelson 1, NW NW SW 14-13n-53w, pumped 80 barrels from Dakota "D" sand, Upper Cretaceous 5586-91 feet, completed 11-4-54, TD 5776.

Kimball County, Unnamed field. James Sloss & Nebraska Drillers, Inc.'s State 2, C NW NW 36-14n-55w, pumped 142 barrels from Dakota "J" sand, Upper Cretaceous 6216-24 feet, completed 11-7-54, TD 6228.

Unnamed field. Tom Palmer, Inc.'s Chaney 1, SW SW SW 27-13n-57w, pumped 240 barrels from Dakota "D" sand, Upper Cretaceous 6888-96 feet, completed 11-12-54, TD 7081.

NEW MEXICO—NEW OIL FIELDS

Lea County, Unnamed field. Continental's O. L. Fisher 1-35, in 35-20s-38e, flowed 98 barrels from Abo lime, Permian 7250-7326 feet, 16/64-inch, 40-gravity, completed 10-28-54, TD 9587.

Unnamed field. Stanolind's Buffalo Unit 1, in 3-19s-33e, pumped 113 barrels oil and 18 barrels water from Wolfcamp lime, Permian 10,597-620 feet, 40-gravity, completed 10-27-54, TD 14,916.

NEW MEXICO—NEW DISTILLATE FIELD

Lea County. Continental's Bell Lake Unit 2, in 30-23s-34e, flowed 140 barrels distillate and 70 barrels water and 13.1 million from Pennsylvanian sand 12,-635-665 feet, open, 55.8-gravity, completed 10-20-54, TD 13,044.

NEW MEXICO—NEW GAS FIELD

San Juan County. Stanolind's Sarah Lilly 1-A, SW NE NE 9-27n-12w, flowed 1.2 million from Pictured Cliffs sand, Upper Cretaceous 1383-1450 feet, open, completed 11-26-54, TD 1450.

NEW MEXICO—OIL FIELD EXTENSION

Chaves County, Drickey field. Roland Rich Woolley's Woolley-Queen-State 1, in 35-13s-31e, 1-mile north extension, pumped 216 barrels from Queen sand, Permian 3053-60 feet, completed 10-31-54, TD 3060.

NEW MEXICO—GAS FIELD EXTENSIONS

Rio Arriba County, Blanco field. Stanolind's Jicarilla Tribal 2, SE NW SE 30-26n-5w, ½-mile southeast extension, flowed 14.0 million from Pictured Cliffs sand, Upper Cretaceous 2898-2948 feet, open, completed 11-26-54, TD 2948.

Blanco field. Superior Oil Co.'s Slagel 1-19, SE NW NW 19-25n-6w, 1-mile southeast extension, flowed 1.2 million from Pictured Cliffs sand, Upper Cretaceous 2772-2800 and 2812-2826 feet,

1st with a JAR SAFETY JOINT

*featuring *adjustability in the hole*

*and **full opening*

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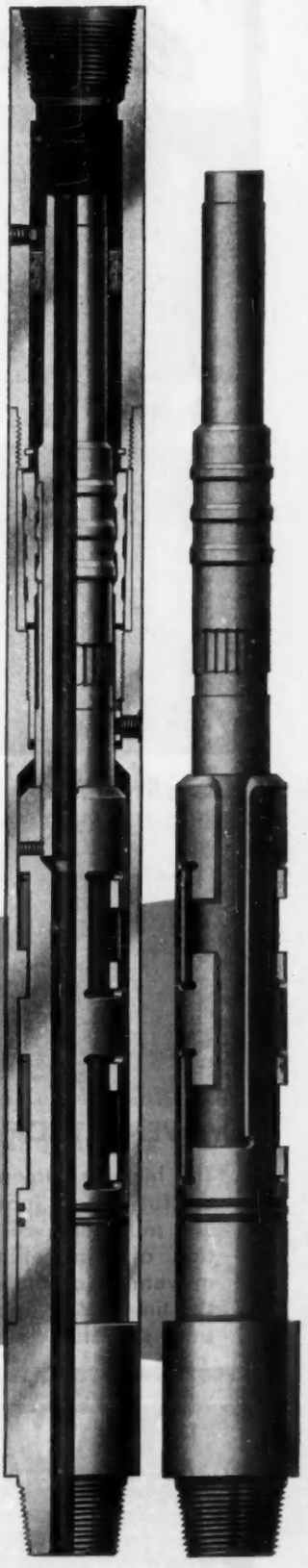

SEALED TYPE I BOWEN JAR SAFETY JOINTS are filled with oil and sealed top and bottom. The Sealed construction enables the tool to transmit circulating fluid at any pressure and prevents any contact between the well fluid and the working parts of the tool. With this arrangement, the moving parts work in a bath of oil and advantages are gained thereby as follows:

Constant Tripping Tonnage: The tripping tonnage does not increase or decrease regardless of the presence of sand or oil in the well fluid. The tripping tonnage can be varied only at the will of the operator.

Lubrication: The oil bath extends the life of the Friction Slip and Friction Mandrel and practically eliminates wear on any other parts.

Infrequent Servicing: These Jars can be used to perform several jobs before it is necessary to service them and the servicing procedure is simplified. The Floater is an important part in SEALED TYPE I BOWEN JAR SAFETY JOINTS. It automatically moves up or down the Washpipe maintaining a pressure balance within the tool and avoiding excessive pressure on the Seals.

SEALED TYPE I BOWEN JAR SAFETY JOINTS are compact combination units designed to provide the services of both rotary jars and safety joints. They are installed as safety devices in strings during testing, coring, reaming, drilling, sidetracking and washing over operations and are also used during fishing operations. At the will of the operator they will either deliver heavy upward or downward blows against a stuck string or fish – or they can be disengaged to salvage all the string that is above them.

***ADJUSTABILITY IN THE HOLE**
You can increase the tripping tonnage without coming out of the hole.

****FULL OPENING**
Oversize circulation hole permits unlimited use of wire line tools and allows passage of large volumes of fluid.

Outstanding Advantages as a Jar

The tripping mechanism in SEALED TYPE I BOWEN JAR SAFETY JOINTS is a straight pull mechanical type.

Torque free operation eliminates any aggravating tendency to release fishing tools, reduces equipment wear, and avoids hazards.

Because the tripping mechanism is purely mechanical, heavy blows can be struck despite packing failures or high temperatures and the same heavy blows will be delivered regardless of whether the string is elevated slowly or rapidly.

The tripping pull can be increased while the tool is in the hole or the tripping pull can be either increased or decreased while the complete tool or just the Bowl Assembly is at the surface.

After considerable service, the wearing parts in SEALED TYPE I BOWEN JAR SAFETY JOINTS can be replaced easily and economically and the tool will regain all the properties of a new one.

Outstanding Advantages as a Safety Joint

SEALED TYPE I BOWEN JAR SAFETY JOINTS will deliver the full torque capacity of the string in either direction.

At the will of the operator, the Bowl Assembly can be separated from the Main Mandrel Assembly of the tool to salvage all of the string that is above it.

Later the Bowl Assembly can be reengaged with the Main Mandrel Assembly in the hole for subsequent recovery operations.

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open, completed 10-29-54, TD 2880.

San Juan County, Blanco field. Benson & Montin's McManus 4, NE SW SE 19-26n-8w, flowed 0.7 million from Pictured Cliffs sand, Upper Cretaceous 2060-2149 feet, open, completed 11-17-54, TD 2149.

OKLAHOMA—NEW OIL FIELDS

Garfield County. D. D. Feldman O&G Co.'s Mae G. Moore 1, SW SE NW 12-21n-3w, flowed 16 barrels oil and 11 barrels water from Red Fork sand, Pennsylvanian 5051-93 feet, 22/64-inch, TD 5648.

McClain County. Carter Oil Co. et al's John Neal 1, NW SE NW 23-6n-3w, flowed 289 barrels from Bromide sand, Ordovician 9238-55 feet, ¼-inch, 41-gravity, TD 10,373.

Seminole County. Amarillo Oil Co. & Seneca Oil Co.'s Harper 1, SW NE NE 6-10n-6e, pumped 176 barrels oil and 25 barrels water from Earlsboro sand, Pennsylvanian 3634-40 feet, 29-gravity, TD 4710.

Stephens County. Schafer Drilling Co.'s Agus Calloway 1, NE NW 6-1n-8w, pumped 9 barrels oil and 1 barrel water from 4524-28 feet, 29-gravity, TD 6513.

OKLAHOMA—NEW DISTILLATE FIELDS

Beaver County, Unnamed field. Fryer & Hansen Drilling Co.'s Shadden 1, C SE SE 26-3n-24ecm, flowed 36 barrels distillate and 6.0 million from Douglas sand, Pennsylvanian 5476-94 feet, TD 7795.

Unnamed field. United Producing Co.'s E. E. Evans 1, C NE SW 8-5n-25ecm, flowed 280 barrels distillate and 20.0 million from Chester lime, Mississippian 6894-6924 feet, TD 7024.

Garvin County. P. G. Lake, Inc.'s Morris 1, C SE NW 20-4n-4w, Old Well Drilled Deeper, flowed 66 barrels distillate and 0.8 million from Hart sand, Pennsylvanian 8884-8924 feet, ¼-inch, 77.3-gravity, TD 10,123.

Woods County. J. V. McDermott's Iva Murrow 1, SW NE 19-27n-16w, flowed 50 barrels distillate and 11.4 million from Mississippi lime, Mississippian 5750-80 feet, TD 7238.

OKLAHOMA—NEW GAS FIELD

Lincoln County. Lee Evans' Cunningham 1, SW SW SW 29-15n-4e, flowed 1.2 million from Lower Skinner sand, Pennsylvanian 4102-12 feet, 20/64-inch, TD 4312.

OKLAHOMA—NEW OIL PAY

Stephens County, Ara, Northwest field. Toklan & Lone Star's R. C. Timmis A-1, NE NW SE 30-1n-4w, pumped 54 barrels from Pickens sand, Pennsylvanian 6765-90 feet, 36.8-gravity, TD 8718.

OKLAHOMA—OIL FIELD EXTENSIONS

Grady County, Bradley field. Phillips Petroleum Co.'s Nye 1, C NE SE 34-5n-5w, ⅜-mile extension, flowed 153 barrels from Springer sand, Pennsylvanian 9875-9960 feet, ½-inch, 38-gravity, TD 10,-721.

Lincoln County, North Sweet Home field. Davidor & Davidor's William A. Wakley 1, SE SE NE 27-15n-3e, ½-mile southeast extension, Old Well Worked Over, flowed 240 barrels from Cleveland sand, Pennsylvanian 3377-88 feet, 15/64-inch. 55-gravity, TD 4441.

Logan County, Seward field. Gulf Oil Corp.'s S. Woolever 1, SW SE NE 26-15n-3w, flowed 75 barrels oil and 100 barrels water from 2nd Wilcox sand, Ordovician 6295-6304 feet, TD 6304.

Osage County, Hardy field. C. W. Oliphant's Osage 1, NW NW SE 12-25n-3e, ¾-mile southeast extension, flowed 917 barrels from Layton sand, Pennsylvanian 2555-67 feet, ½-inch, 40-gravity, TD 3555.

Payne County, Yale-Quay field. Royal O&G Corp.'s Spurgin 1, NW SW NW 29-19n-6e, ½-mile south extension, flowed 37 barrels from Red Fork sand, Pennsylvanian 3179-3210 feet, ½-inch, TD 3210.

Seminole County, Bethel, West field. Russell Cobb, Jr.'s McMahan 1, NE NW SE 12-9n-7e, flowed 48 barrels from Booch sand, Pennsylvanian 3226-34 feet, 18/64-inch, TD 3234.

Texas County, Eva, Northwest field. United Carbon Co., Inc.'s Ralph W. Burns 1, C SW SE 10-4n-19ecm, pumped 83 barrels from Kelley sand, Pennsylvanian 4456-64 feet, 39.5-gravity, TD 4840.

OKLAHOMA—DISTILLATE FIELD EXTENSION

Beaver County, Greenough field. J. M. Huber et al's Davis 1, C NE SW 30-6n-22ecm, flowed 138 barrels distillate and 48.0 million from Morrow sand, Pennsylvanian 6117-6129 feet, open, 60 barrels distillate and 4.8 million from Chester sand, Mississippian 6291-6301 feet, open, TD 6398.

TEXAS DISTRICT 1—NEW OIL FIELD

Frio County, Pearsall field. Sutton Drilling Co.'s Leo Newson 1, Pedro F. Morales Survey 1414, Old Well Drilled Deeper, flowed 648 barrels from Austin chalk, Upper Cretaceous 5240-85 feet, 13/64-inch, 36-gravity, completed 11-12-54, TD 5285.

TEXAS DISTRICT 1—NEW GAS FIELD

La Salle County. Standard of Texas' South Texas Syndicate 2-1, Section 67, H&GN Survey, flowed 0.8 million from 10,258-326 and 10,340-346 feet, 14/64-inch, completed 9-14-54, TD 11,525.

TEXAS DISTRICT 1—NEW OIL PAYS

Guadalupe County, Kingsbury field. Harry Henderson's Ford Imhoff Estate 1, J. H. Kuykendall Survey, flowed 116 barrels from Austin chalk, Upper Cretaceous 2036-64 feet, 3/16-inch, 18.5-gravity, completed 10-29-54, TD 2249.

Wilson County, Lavernia field. Midstates Oil Corp.'s Donald V. Shuhart 1, Manuel Ximenes Survey, pumped 144 barrels from Austin chalk, Upper Cretaceous 2879-2906 feet, 34-gravity, completed 11-7-54, TD 2906.

TEXAS DISTRICT 1—OIL FIELD EXTENSIONS

Atascosa County, "South Crown" field. Sutton Drilling Co.'s R. D. Booth 1, A. Gallaton Survey 1161, 1½-mile west extension, pumped 31 barrels oil and 30 barrels water from Navarro sand, Upper Cretaceous 4374-91 feet, 43-gravity, completed 10-18-54, TD 4510.

Bexar County, Southton field. Bellaire Oil Co.'s John Scoggins 1, Block 4007, Juan Montes Survey, pumped 18 barrels from 693-740 feet, 32.9-gravity, completed 11-27-54, TD 740.

Frio County, Unnamed field. Howeth & Mason and Texas Eastern Producing Co.'s Irma Mills 1, H&GN Survey 437, flowed 240 barrels from Austin chalk,

Upper Cretaceous 5464-5807 feet, open, 26.6-gravity, completed 11-3-54, TD 5807.

TEXAS DISTRICT 2—NEW OIL FIELD

Live Oak County, "Cornelia" field. Hoco-Ellis B. Clavin's Reeves Brown et ux 1, Patrick Nevan Survey, flowed 27 barrels oil and 75 barrels water from 3394-98 feet, 20/64-inch, 25.9-gravity, completed 11-19-54, TD 3679.

TEXAS DISTRICT 2—NEW GAS FIELD

Victoria County. South Texas O&G Co.'s J. H. Tolson 1, Survey 46, flowed estimated 15.0 million from 3118-22 feet, open, completed 9-25-54, TD 4100.

TEXAS DISTRICT 2—NEW OIL PAY

Victoria County, Aloe field. Holloway & Spiller's Victoria County 1, pumped 11 barrels oil and 102 barrels water from Catahoula sand, Oligocene 2644-46 feet, 23-gravity, completed 1-15-54, TD 4612.

TEXAS DISTRICT 2—NEW GAS PAY

Jackson County, S.C.A.R. field. Brazos Oil & Gas Co.-J. P. Petkas' John J. Sablatura et al 1, S. C. A. Rogers Survey, flowed 13.5 million from Frio sand, Oligocene 4876-83 feet, open, completed 11-15-54, TD 6100.

TEXAS DISTRICT 2—GAS FIELD EXTENSION

Goliad County, Maetze field. Daugherty & Kidd's Nora Purcell 1, J. T. Kilgore Survey, flowed 16.0 million from Frio sand, Oligocene 3340-42 feet, open, completed 11-19-54, TD 4012.

TEXAS DISTRICT 3—NEW OIL FIELDS

Chambers County. Tide Water's State Tract 102-1, Subdivision Galveston, Section 102, flowed 205 barrels from 8593-97 feet, 9/64-inch, 39.7-gravity, completed 11-18-54, TD 12,248.

Hardin County, "Yonajosa" field. W. P. Luse & J. B. McAdams, et al's Turner Heirs 1, Turner & Von Rosenburg Survey, flowed 57 barrels from 8026-30 feet, ⅛-inch, 36.7-gravity, completed 10-30-54, TD 9718.

TEXAS DISTRICT 3—NEW OIL FIELDS

Montgomery County. U. S. Epperson Underwriting Co.'s Southland Paper Mills Inc. 3, Walker Survey, pumped 37 barrels from Yegua sand, Eocene 5975-76 feet, ⅛-inch, completed 9-28-54, TD 9506.

Orange County. J. C. Means, Jr. & Wm. Seale's Powell Lumber Co. 1-A, Harry Van Way Survey, flowed 315 barrels from Hackberry sand, Oligocene 8234-36 feet, 10/64-inch, 37-gravity, completed 11-1-54, TD 8916.

TEXAS DISTRICT 3—NEW OIL PAYS

Brazoria County, Collins Lake field. McCarthy O&G Corp.'s J. T. Jamison 1, C. Smith Survey, pumped 65 barrels from 10,164-172 feet, 33.4-gravity, completed 10-7-54, TD 10,633.

Harris County, Fairbanks, Southwest field. Amerada's Nellie Watkins Unit 1, WCRR Co. Survey, flowed 32 barrels oil and 214 water from 6814-18 feet, 11/64-inch, 39.8-gravity, completed 8-26-54, TD 7722.

Liberty County, Martha field. Gulf Coast Leaseholds' C. F. Seaberg 1, Block 15, T&NO RR Farm Lots Subdivision,

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flowed 93 barrels from Lower Yegua sand, Eocene 8116-39 feet, ¼-inch, 38.3-gravity, completed 11-11-54, TD 8240.

Liberty County, Merchant-Hill field. John W. Mecom et al's M. Merchant 1, Section 193, H&TC RR Survey, flowed 215 barrels from Yegua EY-1 sand, Eocene 8764-78 feet, 12/64-inch, 32.1-gravity, and 184 barrels Yegua EY-1A, 8690-8700 feet, 12/64-inch, 33.4-gravity, completed 11-24-54, TD 9271.

Newton County, Call field. Houston Oil Co.'s J. H. Kurth, Jr. Trustee 1, H&TC Survey 42, pumped 10 barrels oil and 23 water from 7104-10 feet, 37.1-gravity, completed 2-17-54, TD 8300.

TEXAS DISTRICT 3—DISTILLATE FIELD EXTENSION

Colorado County, Kennelly field. Magnolia's E. J. Gracey 1, ⅔-mile east extension, flowed 695 barrels distillate and 27.8 million from Wilcox sand, Eocene 9651-9735 feet, open, 46.6-gravity, completed 11-7-54, TD 9735.

TEXAS DISTRICT 4—NEW OIL FIELDS

Aransas County, East Aransas Pass Area. A. O. Morgan & B. A. Wales' J. D. Stanley et al 1, Block 222, John H. Phillips Survey, flowed 191 barrels from Frio E-4 sand, Oligocene 7804-07 feet, 10/64-inch, 38.7-gravity, and 19.5 million from Frio D-5 sand, 7675-80 feet, 65-gravity, completed 11-25-54, TD 8970.

Hidalgo County. Magnolia's Hidalgo-Willacy Oil Co. 1, Las Mestenas Grant, M.T.L.&I. Co. Subdivision, Block 13, Lot 2, flowed 106 barrels oil and 12 water from 11,241-266 and 11,268-277 feet, 9/64-inch, 42.5-gravity, completed 11-25-54, TD 13,000.

San Patricio County, "Midway, East field." Republic Natural Gas Co.'s M. E. McCarthy 1, Section 90, Geo. H. Paul Subdivision, flowed 346 barrels from 8745-55 feet, 10/64-inch, 43-gravity, completed 11-24-54, TD 10,014.

TEXAS DISTRICT 4—NEW DISTILLATE FIELD

Kleberg County, "Sprint field." Sun's State-Gulf 976-1-A, Tract 976, Gulf of Mexico, flowed 70 barrels distillate and 9.3 million from Marginulina sand, Oligocene 9112-38 feet, open, 49.8-gravity, completed 11-18-54, TD 9238.

TEXAS DISTRICT 4—NEW GAS FIELDS

San Patricio County. The Texas Co.'s J. F. Welder Heirs 1, Julian de La Garza Survey, Cubage & Miller Subdivision, Block 1, flowed 4.7 million from Lower Frio sand, Oligocene 7616-28 feet, ¼-inch, completed 11-3-54, TD 8749.

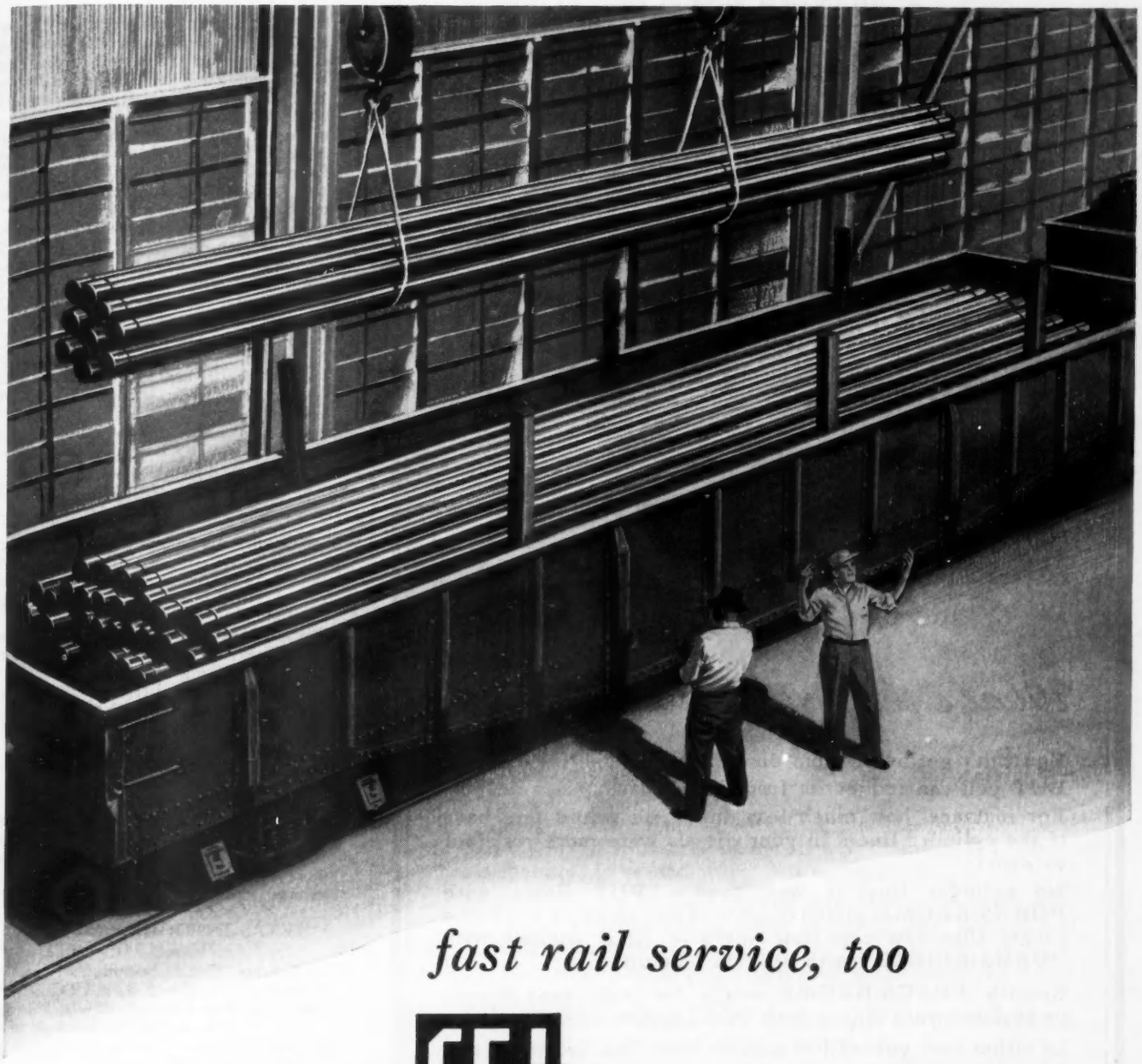
Unnamed field. Wymore Oil Co.'s N. S. Hogue 1, Section 58, Geo. H. Paul Subdivision, flowed estimated 19.0 million from Catahoula sand, Oligocene 2448-52 feet, open, completed 10-15-54, TD 7350.

TEXAS DISTRICT 4—NEW OIL PAYS

Brooks County, Alta Verde field. W. Earle Rowe's Amado de la Garza 1, Section 433, C&M RR Survey, flowed 57 barrels oil and 6 water from Frio sand, Oligocene 3072-78 feet, 9/64-inch, 27.6-gravity, completed 11-19-54, TD 4423.

Palo Blanco field. John L. Sullivan's Kathleen Jones Alexander U-10, Block 38, Los Megueyes de Palo Blanco Grant, flowed 52 barrels from 2460-80 feet, 7/64-inch, 36-gravity, completed 11-27-54, TD 5000.

Duval County, Sejita, East field. Don H.



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Marsh et al's Ortilia Garcia de Olivarez 2, Block 7, Santa Cruz de la Concepcion Grant, pumped 21 barrels from Frio-Vicksburg, Zone 11-B sand, Oligocene 1375-83 feet, 20.5-gravity, completed 11-17-54, TD 1388.

Kenedy County, Sarita field. Humble's Mrs. S. K. East B-6, flowed 98 barrels from Frio 13-H sand, Oligocene 6674-79 and 6682-87 feet, ⅛-inch, 42-gravity, completed 11-9-54, TD 9000.

Kleberg County, Borregos field. Humble's King Ranch-Borregos 134, flowed 52 barrels oil and 9 water from Frio S-7 sand, Oligocene 6936-43 feet, ⅛-inch, 39.6-gravity, completed 11-11-54, TD 7277.

Nueces County, Baldwin field. Republic Natural's W. M. Bevly 1, W. Cody Survey, flowed 104 barrels from Sinton sand, Oligocene 6094-6100 feet, ⅛-inch, 46-gravity, completed 11-15-54, TD 8919.

San Patricio County, Edwin field. Bright & Schiff's T&NO RR 1, A. Herron Survey, Old Well Worked Over, flowed 135 barrels from 6812-24 feet, 28/64-inch, 39-gravity, completed 11-19-54, TD 6940.

Starr County, La Copita field. Shell's Bentsen Bros.-State 5, F. Alvarado Survey, flowed 52 barrels from Frio sand, Oligocene 4770-73 feet, 8/64-inch, 50-gravity, completed 11-18-54, TD 4917.

Willacy County, La Sara field. The Superior's Yturria Cattle Co. 5, San Juan de Carricites Grant, flowed 34 barrels oil and 4 water from Frio sand, Oligocene 6162-64 feet, 16/64-inch, 42.5-gravity, completed 11-12-54, TD 7638.

TEXAS DISTRICT 4—NEW DISTILLATE PAY

Webb County, Aguilares field. Skelley's J. C. Martin 2, LIM & C Survey, flowed 250 barrels distillate and 16.2 million from Wilcox Zone 6 sand, Eocene 6872-78 and 6886-92 feet, open, 51-gravity, completed 11-4-54, TD 7000.

TEXAS DISTRICT 7-C—NEW OIL FIELDS

Coke County. Homer Snowden's Nora Gee 1, Section 144, Block 2, H&TC Survey, Old Well Worked Over, flowed 268 barrels from Strawn sand, Pennsylvanian 7086-7103, feet, 10/64-inch, 41-gravity, completed 10-1-54, TD 8331.

Crockett County. Gulf's J. B. Tippett 1-E, Section 38, Block 31, H&TC Survey, flowed 28 barrels oil and 5 barrels water from Lower Clearfork lime, Permian 4195-4610 feet, ½-inch, 37.6-gravity, completed 11-9-54, TD 6911.

Reagan County. The Texas Co.'s Lula Wilson Young 1, Section 1, GC&SF Survey, flowed 1669 barrels from Fusselman lime, Silurian 9273-9346 feet, 28/64-inch, 44-gravity, completed 11-12-54, TD 9346.

Runnels County. Gilchrist Drilling Co.'s A. S. Alcorn 1, Section 124, ETRR Survey, Old Well Worked Over, flowed 137 barrels from Fry sand, Pennsylvanian 3595-3603 feet, 12/64-inch, 41-gravity, completed 10-29-54, TD 3920.

TEXAS DISTRICT 7-C—NEW GAS FIELD

Crockett County. Stanolind & Dalton H. Cobb's Addie Clayton A-1, Section 31, Block EF, GC&SF Survey, flowed 1.3 million from Ellenburger lime, Ordovician 8535-65 feet, open, .687-gravity, completed 10-18-54, TD 8971.

TEXAS DISTRICT 7-C—NEW OIL PAY

Runnels County, Crews, South field.

Thomas D. Humphrey & Sons, Ltd.'s Bryan Clayton 4, Block 18, A. Losoya Survey 515, flowed 108 barrels from King sand, Pennsylvanian 2166-71 feet, 16/64-inch, 43.7-gravity, completed 10-20-54, TD 2171.

TEXAS DISTRICT 7-C—GAS FIELD EXTENSION

Sutton County, Senora field. Superior's Ben F. Meckel 13-1, Section 13, GC&SF Survey, 1-mile northeast extension, flowed 1.6 million from Canyon sand, Pennsylvanian 5560-76 and 5640-50 feet, open, completed 10-25-54, TD 5905.

TEXAS DISTRICT 8—NEW OIL FIELDS

Crane County, Unnamed field. J. J. Moran, Trustee's Raymond Reed et al 1, Section 10, Block 4, H&TC Survey, flowed 150 barrels from Waddell sand, Ordovician 5790-5844 feet, 16/64-inch, 40-gravity, completed 10-20-54, TD 6555. **Unnamed field.** Liedtke & Liedtke et al & Zapata Petroleum Co.'s J. B. Tubb 1, Section 18, Block B-20, PSL Survey, pumped 30 barrels oil and 10 water from Glorieta lime, Permian 4057-73 and 4082-90 feet, 34-gravity, completed 10-29-54, TD 4150.

Garza County. Western Drilling Co.'s J. S. Boren 1, Section 104, Block 5, H&GN Survey, pumped 15 barrels oil and 45 water from San Andres lime, Permian 2536-55 feet, 34.1-gravity, completed 10-21-54, TD 2774.

Howard County. Cosden's Modesta Good Simpson 1, Section 22, Block 33, T-3-N, T&P Survey, flowed 216 barrels oil and 298 water from Reef lime, Pennsylvanian 8620-53 feet, ½-inch, 42-gravity, completed 11-4-54, TD 8653. **Unnamed field.** Warren-Bradshaw Exploration Co.'s TXL A-1, Section 41, Block 30, T-1-S, T&P Survey, pumped 57 barrels oil and 24 water from Glorieta lime, Permian 2640-2744 feet, 31-gravity, completed 11-9-54, TD 2744.

Kent County. Woodson Oil Co.'s C. E. Cargile 1, Section 25, Block 5, H&GH Survey, Old Well Drilled Deeper, pumped 183 barrels oil and 95 water from Ellenburger lime, Ordovician 7778-7812 feet, 42.3-gravity, completed 11-4-54, TD 7876.

Ward County. British-American's J. B. Tubb 1, Section 13, Block B-20, PSL Survey, flowed 313 barrels from Ellenburger lime, Ordovician 8236-60 feet, 16/64-inch, 48.5-gravity, completed 11-8-54, TD 8390.

TEXAS DISTRICT 8—NEW DISTILLATE FIELD

Ward County, Block 17 field. Magnolia's U-Tex B-1, Section 34, Block 17, University Lands Survey, flowed 401 barrels distillate and 36.5 million from Delaware sand, Permian 5015-18 feet, open, 62-gravity, completed 4-27-54, TD 5227.

TEXAS DISTRICT 8—NEW GAS FIELDS

Pecos County. Brown & Thorp Drilling Co.'s Magnolia-Fee 1, Section 3, Block 212, J. H. Humphreys Survey, flowed 2.2 million from Tubb lime, Permian 3016-3112 feet, open, completed 10-2-54, TD 4072.

Reeves County. Gulf & Phillips' Mrs. V. L. Shurtleff-(Toyah Unit) 1, Section 20, Block C-17, PSL Survey, flowed 65.0 million Devonian lime 12,570-610 and 12,690-795 feet, open, completed 10-16-54, TD 15,038.

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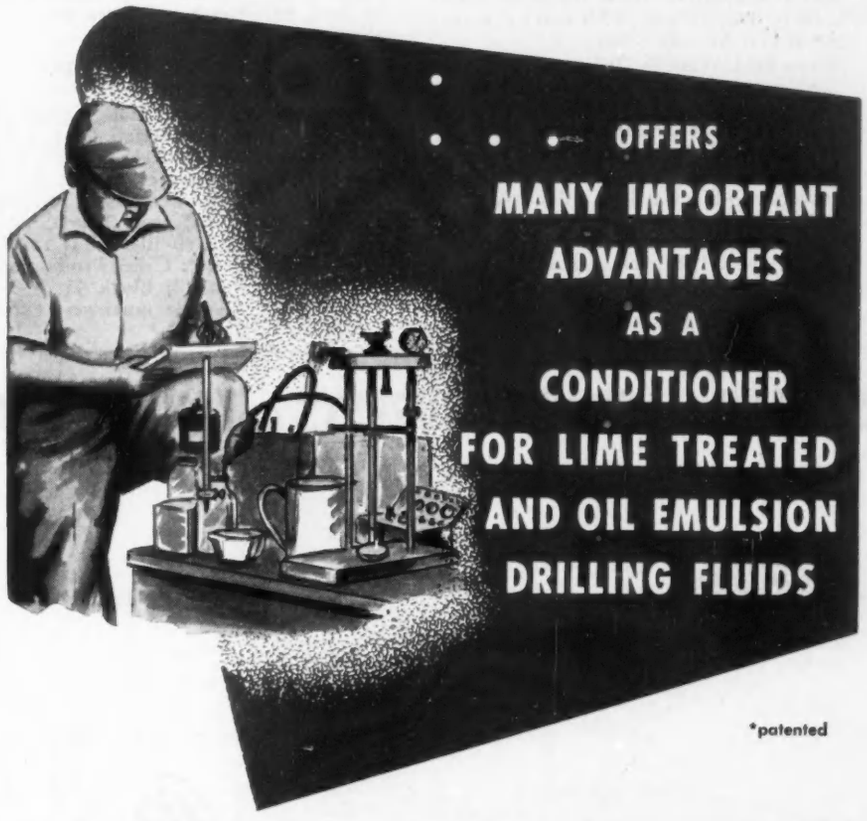

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TEXAS DISTRICT 8—NEW OIL PAYS

Andrews County, Embar field. Phillips' Embar B-3, Section 5, Block 44, T-2-N, T&P Survey, Old Well Drilled Deeper, flowed 976 barrels from Devonian lime 9346-70 feet, ½-inch, 43.8-gravity, completed 11-7-54, TD 9860.

Means field. Western Drilling Co.'s F. E. Gardener 3, Section 16, Block A-35, PSL Survey, flowed 161 barrels from Grayburg lime, Permian 4424-54 feet, 20/64-inch, 34.4-gravity, completed 10-19-54, TD 4454.

University—Block 9 field. Atlantic's University 9-E-1, Section 14, Block 9, University Lands Survey, Old Well Worked Over, flowed 198 barrels from Pennsylvanian lime, 8966-9000 feet, ⅜-inch, 42.5-gravity, completed 8-19-54, TD 10,800.

Borden County, Arthur field. Seaboard et al's T. J. Good 1-45, Section 45, Block 33, T-4-S, T&P Survey, flowed 229 barrels from Reef lime, Pennsylvanian 8784-98 feet, 13/64-inch, 43.3-gravity, completed 11-22-54, TD 8853.

TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Midland County, Virey field. Forest Oil Corp. & Cities Production Corp.'s Fee 15-1, Section 15, Block 41, T-3-S, T&P Survey, ½-mile west extension, flowed 3,202 barrels from Ellenburger lime, Ordovician 13,055-292 feet, 1-inch, 52.2-gravity, completed 10-30-54, TD 13,292.

Virey field. Forest & Cities Production's Fee 22-1, Section 22, Block 41, T-3-S, T&P Survey, ½-mile northwest extension, flowed 2,319 barrels from Ellenburger lime, Ordovician 13,104-322 feet, 1-inch, 52.1-gravity, completed 10-29-54, TD 13,322.

Warsan field. Forest & Cities Production's Fee 46-1, Section 46, Block 41, T-3-S, T&P Survey, ½-mile south extension, flowed 2,788 barrels from Ellenburger lime, Odrovician 13,076-244 feet, 1-inch, 52-gravity, completed 10-31-54, TD 13,244.

TEXAS DISTRICT 10—NEW DISTILLATE FIELD

Hansford County. Sharples Oil Corp.'s A. R. Henderson 1, Section 95, Block 45, H&TC Survey, flowed 46 barrels distillate and 7.7 million from Cherokee sand, Pennsylvanian 6258-60 feet, completed 11-2-54, TD 7570.

UTAH—NEW OIL FIELD

San Juan County. Shell's Desert Creek 2, SE SE 35-41s-23e, flowed 214 barrels from Hermosa (Paradox) sand, Pennsylvanian 5244-5320 feet, 14/64-inch, 41-gravity, completed 11-20-54, TD 7230.

WYOMING—NEW OIL FIELDS

Natrona County, Unnamed field. Stanolind's Sherwood Unit 1, NE NE SW 3-40n-77w, flowed 83 barrels from Lakota sand, Lower Cretaceous 11,017-032 feet, 20/64-inch completed 11-8-54, TD 11,512.

Unnamed field. True-Brown-Fulton's State 1, C NW SE 8-31n-81w, flowed 110 barrels from Frontier sand, Upper Cretaceous 1170-79 feet, completed 10-8-54, TD 4029.

Niobrara County. Sapphire American Petroleum Co.'s Government 1, C SW NW 34-41n-66w, pumped 192 barrels from Newcastle lime, Upper Cretaceous 7546-49 and 7556-68 feet; completed 10-26-54, TD 7680.

Park County. Trigood Oil Co.'s Meteetse Unit 1, C SE NW 28-49n-99w, pumped 115 barrels from Dinwoody sand, Triassic 11,234-54 and 11,265-78 feet, completed 11-8-54, TD 11,471.

Weston County, Unnamed field. Coronado Petroleum Co.'s Government Chism 1, C SE NE 33-45n-62w, pumped 90 barrels from Newcastle lime, Upper Cretaceous 3169-75 feet, completed 11-14-54, TD 3225.

Unnamed field. Ohio Oil Co.'s Emery-Gov't 1, SW NE SW 18-41n-66w, flowed 67 barrels from Newcastle lime, Upper Cretaceous 7660-76 feet, completed 11-7-54, TD 7932.

WYOMING—NEW GAS FIELDS

Carbon County. Phillips' Unit 1, C NE NW 9-12n-92w, flowed 4.7 million from Lewis sand, Upper Cretaceous 4692-4720 feet, open, completed 11-23-54, TD 8580.

Hot Springs County. Mobil Production Co.'s F-22-32-G, SW SE NW 32-45n-99w, flowed 1.3 million from 3rd Frontier sand, Upper Cretaceous 3578-88 feet, open, completed 11-3-54, TD 7030.

WYOMING—OIL FIELD EXTENSION

Sheridan County, Decker field. C.M. & W. Drilling Co.'s Homer Scott 1, C SE SE 31-58n-84w, ½-mile south extension, pumped 236 barrels from Shannon sand, Upper Cretaceous 4843-4875 feet, completed 11-4-54, TD 4924.

WYOMING—GAS FIELD EXTENSION

Sweetwater County, Canyon Creek field. Mountain Fuel Supply Co.'s Unit 6, NE NE NW 16-12n-101w, flowed 11.7 million from Mesaverde sand, Upper Cretaceous 4797-5775 feet, completed 11-16-54, TD 5782.

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A Special Report on . . .

Air and Gas Drilling

IN A MATTER of years, air drilling techniques, including their use for aerating fluid columns, will be put in harness alongside mud drilling to carry a proportional share of total footage drilled. Now's the time to learn how and where air and gas drilling can be used.

This special report on air and gas drilling follows the pattern set in 1954 in presenting special material on new and timely drilling developments. Our editors have labored long to bring you high interest material designed to give information leading to an intelligent decision on whether to use air and gas drilling. Some market data is also presented for manufacturers.

WHERE TO FIND IT

The air and gas drilling experiments reported in this issue were made under conditions exceptionally favorable. Generally, these conditions were:

- Formations were generally hard.
- There were few wet zones.
- There were few formations subject to sloughing or caving when wet.
- Serious lost circulation problems or low-pressure gas formations easily damaged by mud gave a strong incentive for air drilling.

There is no magic formula. Only careful consideration of individual factors in light of local geologic conditions existing in an area will lead to its intelligent use. If this practice is followed, favorable results are almost certain.

Wide application of air and gas drilling await the solution of many problems. They include:

- Way to dry up wet formations.
- Ways to squeeze off water zones.
- Mastering the techniques of water flow.
- Revising casing programs to handle water and caving formation.
- Revising drilling techniques to cope with crooked hole problems.
- Development of chemical and/or plastics to effect a water block.

Successful solutions to these problems are dependent upon equipment development and a great deal on the experience by operators. These problems will be discussed in detail in the February issue of WORLD OIL.

The future for this concept of drilling, and the significant recent developments deserve close observation and it is WORLD OIL's sincere hope that these presentations will help the industry solve the problems sooner.

PHILIP L. McLAUGHLIN
DRILLING EDITOR

Because of keen interest shown by operators, contractors and compressor manufacturers, WORLD OIL will publish pertinent articles on this subject in two issues.

JANUARY ISSUE...offers case history information on wells drilled with air or gas from scattered sections of the country.

FEBRUARY ISSUE..will give answers to questions most asked about equipment, market, economics, aerated fluid columns, and the future for air drilling.

WHAT SPECIAL SURFACE EQUIPMENT IS NECESSARY TO DRILL WITH AIR?
Compressors 111, 118, 120, 127, 138, 143, 146, 148
Surface connections 111, 122, 127, 130, 132
Rotating preventor heads.....111, 120, 127, 130, 132
Cost 125, 127, 132, 150

WHAT ADVANTAGES RESULT FROM USE OF AIR?
Faster penetration rates.....110, 118, 134, 138, 140
Fewer bits 124, 125, 126, 134, 143
Cleaner completions 110, 134, 146, 148
Other advantages 110, 114, 125, 126, 127, 134, 143, 150

WHAT ARE CURRENT LIMITATIONS?
.....120, 122, 138, 140, 143, 146

WET FORMATIONS AND WATER FLOWS ARE DETERRENTS
Present solutions 114, 118, 120, 138, 140, 143, 146
Future techniques 122, 146
Demand on compressor output..118, 138

WHAT CONDITIONS ARE FAVORABLE FOR AIR DRILLING?
Hard-rock country 114
Lost circulation areas.....126, 127, 143
Difficult producing zone.....110, 122
Water service areas.....110, 143
Other 111, 122

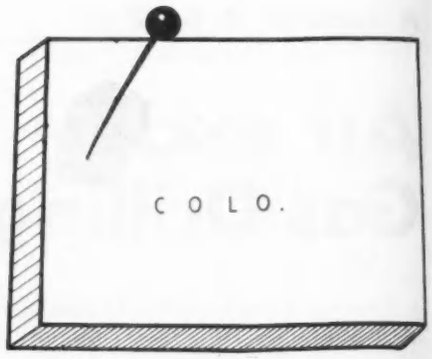
CAN EXPLOSIONS OCCUR UNDERGROUND?
Combustible air-gas mixtures...120, 150
Exhaust gas drilling.....February
Nitrogen drilling 150
Aerated mud drilling.....February
Natural gas drilling.....122, 138

WHAT ABOUT AERATED FLUID DRILLINGS? . . . February issue
FOR WHAT DRILLING APPLICATION CAN AIR BE USED?
Surface holes 118
Deep drilling 111, 118, 122
Well completions and test.....110, 111, 120, 146, 148
Specific areal applications.....122, 126

TECHNICAL INDEX ON HIGH INTEREST AIR DRILLING SUBJECTS
Bits and their performance.....114, 118, 120, 122, 124, 126, 134, 138 140, 143, 152
Blowouts 118, 122
Crooked hole conditions.....111, 118, 126, 143
Compressor design and types....111, 116, 120, 126, 127, 138, 148
Cuttings 112, 130
Casing programs 111, 120, 127
Coring 111, 114
Case histories.....110, 114, 116, 124, 127, 132, 138, 140 143, 146
Costs 125, 126, 132, 138
Special drill strings.....146, 150
Drill pipe abrasion.....111
Reamers 120, 132, 140
Gas drilling 122, 138
Increasing air density.....146
Intercooler and aftercooler requirements 122, 127
References.....February
Return velocity 120, 132
Reverse circulation 118, 146
Slim hole drilling.....160, 164
Special liners.....February
Strain on rig.....118
Squeeze techniques 118
Testing 111, 120, 122, 138
Temperature surveys.....February
Whipstocks 146
Well logs applicable.....146
Weights 111, 118, 126, 138, 152
Special equipment 127, 138

WHAT THE FUTURE HOLDS 114, 112

THE CLOUD OF DUST emitted from drilling operations on El Paso Natural Gas Company's Prairie Unit 1 in Garfield County Colorado, stands out against the mountainous terrain.



IN COLORADO

How Air and Gas Drilling Aided Wildcat Operations

El Paso Natural Gas got good results using a mobile compressor and an engineering service.

By L. S. FULLER, Drilling Superintendent,
and **DALE E. LOCKETT,** Petroleum Engineer,
El Paso Natural Gas Company, Salt Lake City, Utah

EL PASO NATURAL GAS COMPANY has for several years advocated the use of air and gas drilling. In their operations, they have used this method of drilling as a standard completion practice and have drilled many thousands of feet of hole under varied conditions. With this wide experience as a background, they have extended the use of this type of drilling to their wildcat drilling operations.

This report is not on the company's over-all wildcat drilling operations, but rather is specifically restricted to three wildcat wells that were drilled in Garfield and Mesa counties, Colorado, in 1954. The principal circulating medium for these operations was compressed air. The reason for the choice of this type of circulation was based on the following factors:

1. The primary object of these wildcats was the development of gas reserves. The use of air as a circulating medium eliminated any possibility of sealing off gas zones and was thus the foremost consideration in the proposed testing of possible gas horizons.
2. Compressed air would effect a cost savings in the drilling operation due to an increase in penetration rates and bit life.
3. Any gas horizons encountered could be easily and conveniently tested for production rates and pressures while drilling with air.
4. The region was especially suited for air drilling as there were no known water bearing horizons which would be encountered above the projected producing zones.
5. The El Paso Natural Gas Company's wide experience in this type of drilling provided them with trained personnel which would expedite the drilling procedures.
6. There was available in this area adequate compressor equipment and technical help.

Equipment. The contract for drilling these wells was let to the Barron Drill-

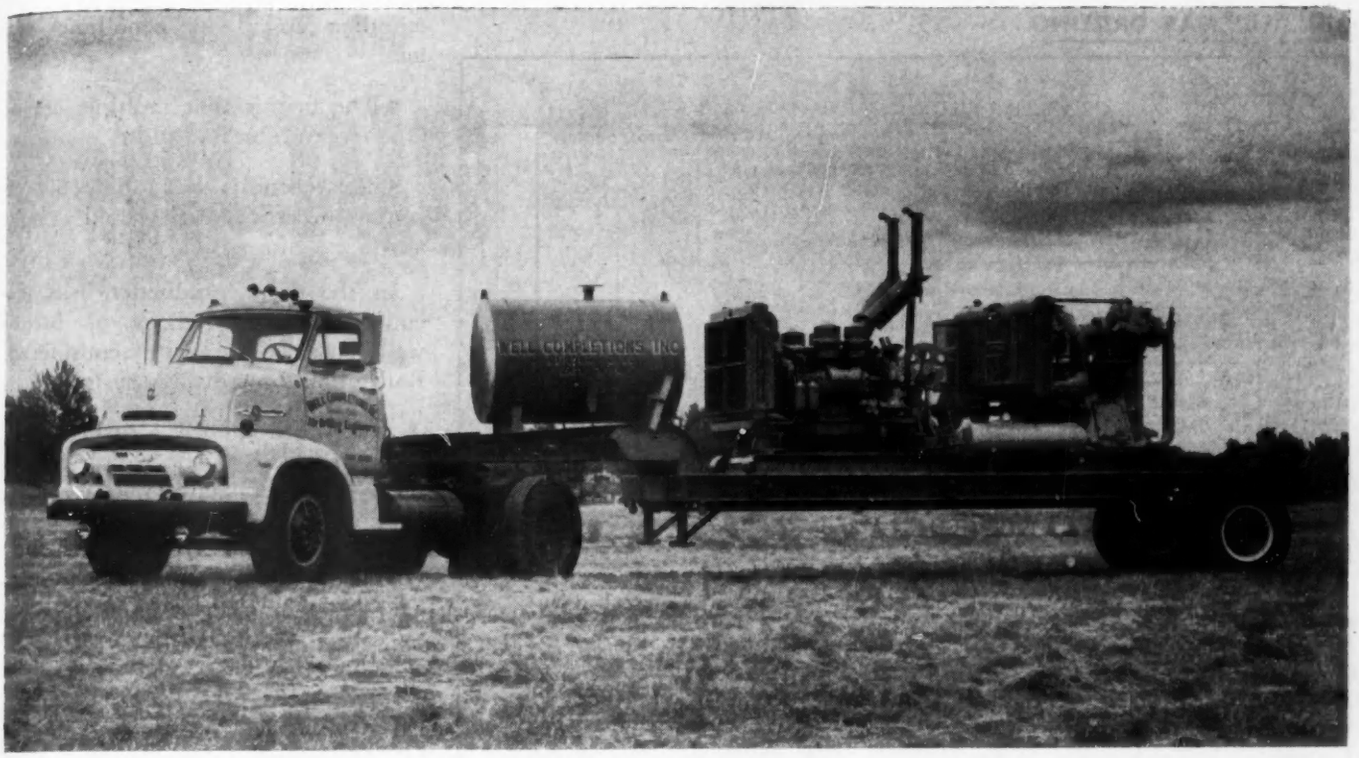


Fig. 1—El Paso Natural Gas Company used this type of portable compressor unit for an air drilling operations on the three Colorado wildcats. This unit is particularly adaptable to mountain drilling since it is capable of pressures required by most air drilling and is portable.

ing Company of Farmington, N. M. The rig furnished was equipped with a SAL 5000 drawworks and a 96 foot, 150,000 pound derrick. Blowout preventer equipment consisted of a 10-inch, 900 Series double gated blowout preventer, and a 10-inch, 900 Series rotating head with 3½-inch stripper rubbers.

A blow line of 6⅝-inch outside diameter line pipe type "B", 200 feet in length, was laid from the casing head and securely anchored to the ground. A small line was also run alongside the blow line for the butane to be used as a pilot flare. Drill pipe used was 3½-inch internal flush and the drill collars were 5¾-inch OD. A standard rubber rotary hose and a square 4½-inch kelly were used. It was considered advisable to pack all steel hose connections, packings, glands and valves with a high temperature grease due to the temperature experienced from the compressed air; in this case, in the neighborhood of 220° F, with the ambient temperature sometimes 100° F.

The compressor equipment was secured from Well Completions, Inc., a service company offering air drilling engineering service to the petroleum industry. Two compressor units were furnished, giving a standpipe volume of 2,160,000 CFPD at 265 pounds per square inch, considered more than ample for the projected depth and hole size. Each unit was of the type shown in Figure 1, mounting a high speed, two stage compressor with double acting pistons. The compressors were powered by diesel engines and mounted on low-boy type trailers. They were completely unitized with fuel tank and circulating cooling system.

Geology. The three wells were spudded in the Mancos formation, which primarily consists of 2500 to 2900 feet of shale, overlaying the Dakota section; the Dakota consisting of 250 to 325 feet of sands and shales. The projected total depth between 3000 and 4000 feet was to the Morrison formation, also composed of sands and shales.

Possible gas production was expected in either the Dakota or Morrison sections; however, it was also known that if the Dakota formation was barren of gas production, in all probability it would be water bearing.

Drilling and production procedures. The first of the three wells, the Prairie Unit 1, was supdded in May 31, 1954. The surface holes were drilled using water and bentonite for circulating fluid and 9⅝-inch casing was set in 12¼-inch hole. Surface casing was cemented by the circulation method, pumping the plug down with water. The casing was tested with the rig pump and then the water was blown out of the hole and the casing dried before drilling the shoe with air.

The holes were drilled with 7⅞-inch hard formation tri-cone rock bits and phenomenal penetration rates were experienced. Weight on the bit varied between 5,000 and 10,000 pounds and the rotary speed used was 60 to 100 revolutions per minute. In most instances the bits were not pulled for dullness, but rather to check the bearings. No wear attributable to the air drilling was noticed on the drill pipe or drill collars, and no crooked hole tendencies were encountered.

Coring with air was accomplished in a manner similar to that of coring with mud. Using a 6⅛-inch diamond core head, excellent penetration rates were experienced running 6000 pounds of weight at 65 RPM and 150-200 psi standpipe air pressure.

Testing of gas formations. As long as air is the circulating medium no formation testing is required, for with this type of drilling a continual test is in progress. When the well is

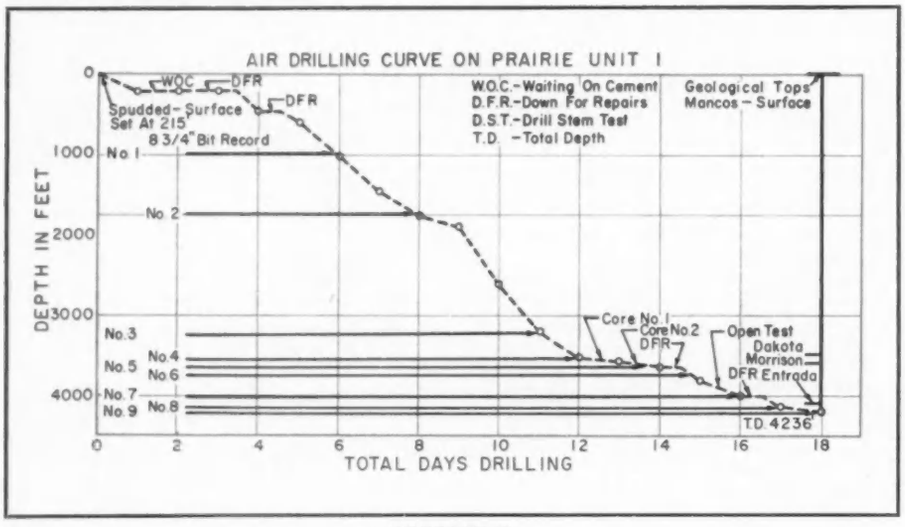


FIGURE 2

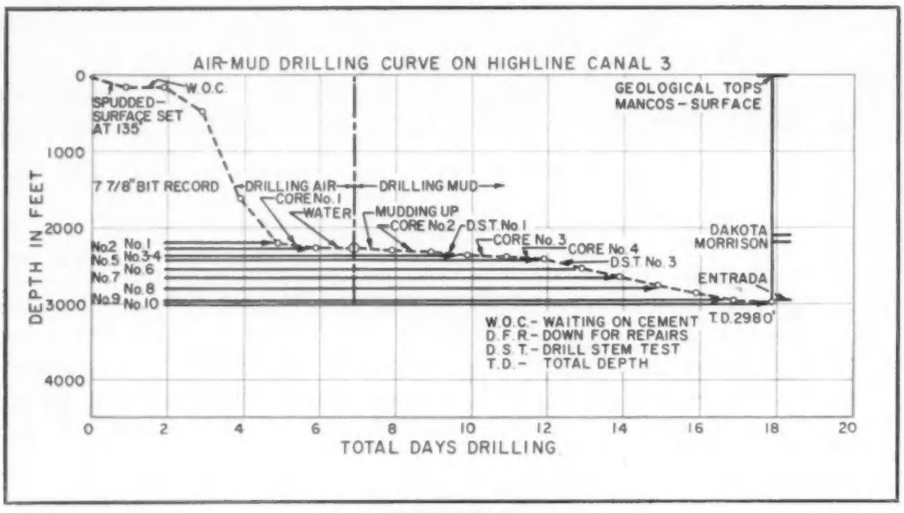


FIGURE 3

"dusting," the hole is dry and penetration is being made. The absence of "dusting" is indicative of fluids, and by blowing the hole the fluids are brought to the surface. An increase in return volume is evidence of natural gases and by maintaining a pilot flare at the blow line, the smallest amounts are detectable. Discontinuing the air supply, closing the preventer and placing a gage on the drill pipe, the formation may be accurately tested for both volume and pressure without removing the bit or making a trip. Gas shows as small as 18 thousand cubic feet per day were tested in this manner. This method of testing would have been impossible with mud drilling.

Geologist can interpret cuttings. The cuttings are removed at such a high annular velocity that sample lag time is negligible. Samples are of minute particle size and must be examined under a microscope. The geologists have become quite adept at working these cuttings and now have little difficulty interpreting the characteristics of the formation encountered.

When water was encountered in the Dakota section all wells had to be mudded up, with exception of the Prairie Unit 1. In the original planning, it was the intent to mud up when total depth was reached for the running of electrical surveys. Production casing was then to be run in a mudded hole, setting through the the producing zones and perforating for production. Ten to 12 hours was all that was necessary to change from air to mud circulation. No sloughing of formation was encountered when water was placed in the dry hole.

Casing can be run in dry hole. Production casing can be run and set in an air drilled hole without mudding up if two conditions are met.

- The first is that multiple stages of cement are not required.
- The second is that radioactive or contact electrical logs would supply adequate information.

In the event production was encountered two methods of future well completions were considered. Both utilized air drilling systems.

1. With area control, a casing depth is picked from correlation of logs a few feet above the expected producing zone. This depth is reached with air drilling and radioactive type log run to correlate and check the depth. The casing is run using a standard cementing float collar and guide shoe with casing centralizers. Scratchers were not used due to total absence of mud cake. Casing is run in the dry hole and landed on bottom. Casing is then filled with water; water being displaced ahead of the cement. Cement is followed by the single stage method, where the plug is pumped down with water. The top of cement was to be determined by a temperature survey of the well after cement was in place behind the casing. Water would then be blown from the casing and the pipe dried up. The float, shoe, and expected producing formation are then drilled with air. A water shut off test is automatically made when the plug is drilled with air. The producing formation, after air drilling, is uncontaminated and ready to be put on production or to receive any other completion techniques.

2. The second well completion method would be when the producing zone is to be drilled through and tested with air, and the production casing to be set above the zone. In such an instance the procedure would be the same as outlined in the first method, with the exception of setting an open hole bridging plug above the producing zone to keep the gas off the rig floor and to isolate the zone from fluid contamination while cementing. After the casing is cemented, water is blown out and the float, shoe and

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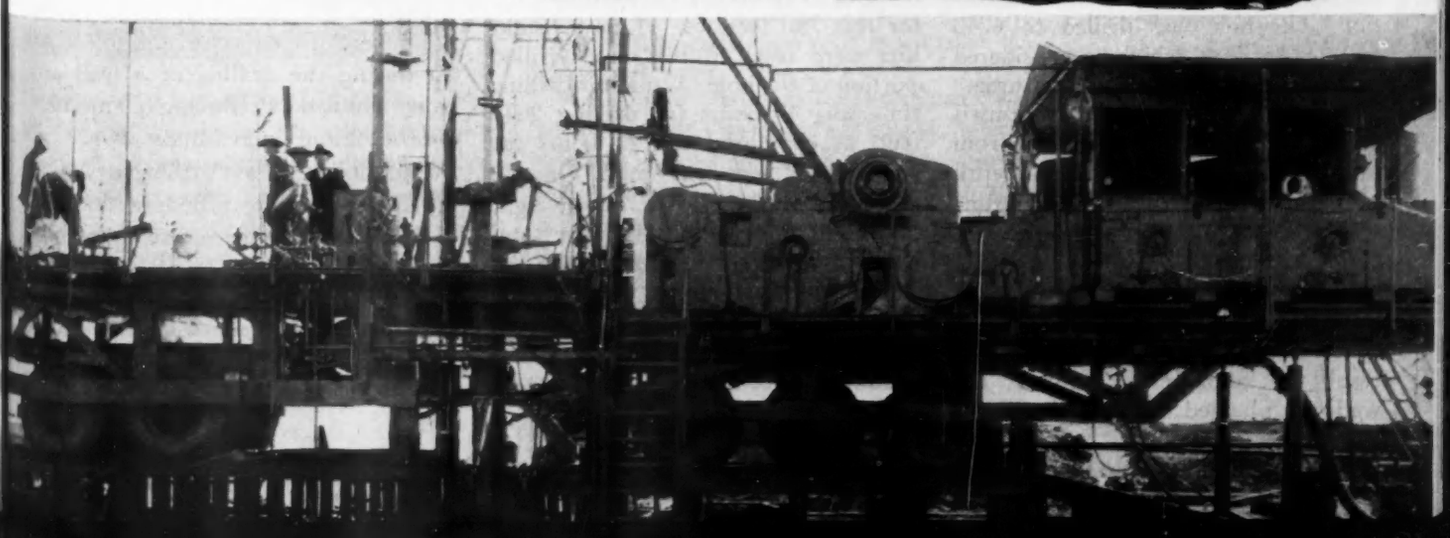
Constructed of the finest "Manten" steel and mounted on a separate trailer, the mast has less than 75′ overall length and 10′ width including truck, when folded for transporting. The fifth wheel is built into the upper section so that the tractor can be backed directly under it. The Wilson Giant Torcair Two-engine Rig is mounted on the other trailer so that the entire unit can be quickly and easily transported from location to location.

This complete new rig, proven under extreme field conditions, definitely solves the problem and need for portability in a medium depth drilling rig. Another plus is that the operator has a mast of rigid design that can be used under any conditions.

● *Photo at left:* Here is an overall view of the rig with mast extended to full height. Note that the only guys needed are side "wind-guys" attached to outriggers extending from the ramps. The guyless feature saves many hours during rigging up operations and is especially valuable in swampy or rocky areas.

● *Photo below:* An overall closeup view of the two trailers as they are positioned over the hole. The ramps under the trailers are placed so that trailers line up perfectly, with little effort and time. The ramps also provide added height to clear blowout preventers. Note the large working area on the derrick floor.



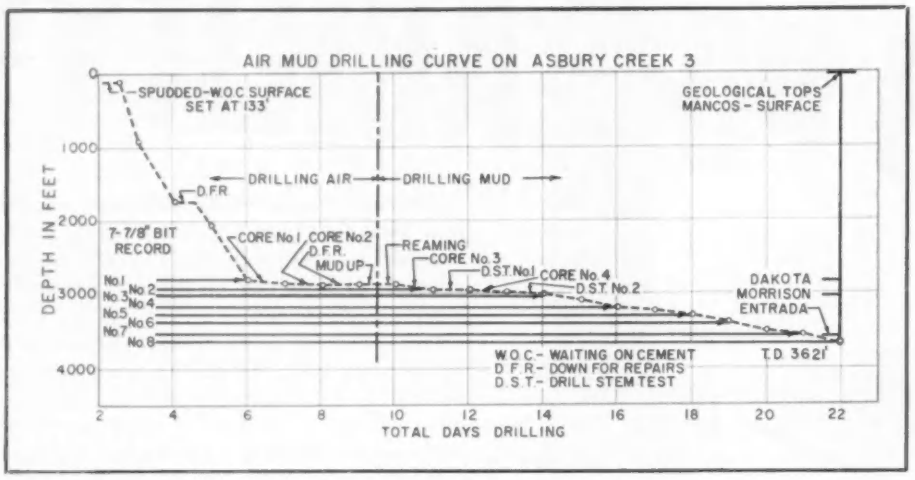


FIGURE 4

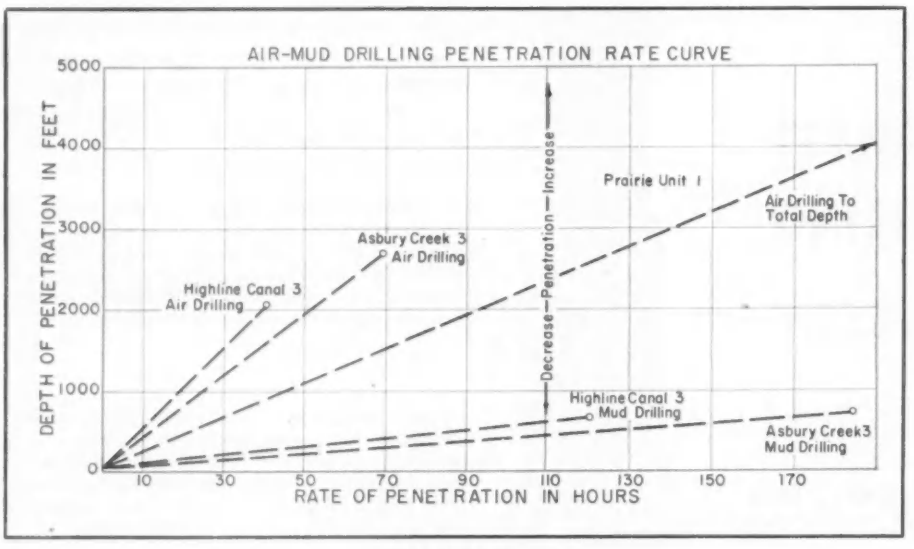

AIR-MUD DRILLING PENETRATION RATE CURVE
Prairie Unit 1
Air Drilling To Total Depth
Asbury Creek 3 Air Drilling
Highline Canal 3 Air Drilling
Decrease — Penetration — Increase
Highline Canal 3 Mud Drilling
Asbury Creek 3 Mud Drilling
DEPTH OF PENETRATION IN FEET
RATE OF PENETRATION IN HOURS

FIGURE 5

bridging plug is drilled and the well cleaned to bottom with air.

Well histories

Prairie Unit 1—Surface casing was set at 215 feet with cement circulated to surface using normal fluid drilling methods. This well was drilled to the Morrison formation with air and did not encounter water in Dakota section. The hole was drilled to 4240 feet in 15 days which is considered excellent drilling time for that area.

Nine hard formation bits were used on the well. Actual drilling time from under surface casing to total depth was 200 hours with air. Coring time with air was 12 hours with 72 feet cut.

No production was encountered and the hole was filled with water so that electric logs could be run. The results of tests being negative, the well was plugged and abandoned.

Highline Canal 3—Surface casing was set at 135 feet with cement circulated to surface using normal fluid drilling methods. The hole was drilled to 2233 feet in four days with air before encountering water in the Dakota section and mudding up. Two hard formation bits were used in this portion of the hole. Mud was used from 2233 to 2983 feet. Drilling time for this 750 feet was 11 days. Eight bits were used in this mud drilled portion of the hole. Actual air drilling time was 40 hours for drilling 2040 feet, as compared to 121 hours for drilling 648 feet with mud. One 58 foot core was cut with air in eight hours. Four cores of 102 feet total were cut in 47 hours using mud.

The well was plugged back to 2335 and 5½-inch casing set to test possible production. However no gas was produced in commercial quantities so well was plugged and abandoned.

Asbury Creek 3—Surface casing was set at 133 feet with cement circulated to the surface using normal fluid drilling methods. The hole was drilled to 2814 feet in four days using one hard formation bit. The hole was then cored ahead to 2863, coring 49 feet in five hours. Water was again encountered in the Dakota and the well was mudded up at this point. Mud was used from 2814 to 3621 feet total depth.

This portion of the hole required 15 days to drill and ream the 807 feet. Eight bits were used in the mud drilled portion of the hole. Actual drilling time was 69 hours for drilling 2681 feet with air as compared to 186 hours for drilling 745 feet with mud. Two cores totaling 62 feet were cut in 18 hours with mud.

The well was plugged back to 3045 feet and 5½-inch casing run to test possible production from the lower Dakota formation. However, only a small amount of gas was produced before the well went to salt water. Well was then plugged and abandoned.

Conclusion. Air drilling is especially suited and valuable in wildcatting operations where hard, dry formations are to be penetrated. Drilling time is reduced considerably and the progress of the well is generally speeded up. The trouble of loss circulation and expensive water hauling is reduced. The possibility of passing up a productive horizon is eliminated.

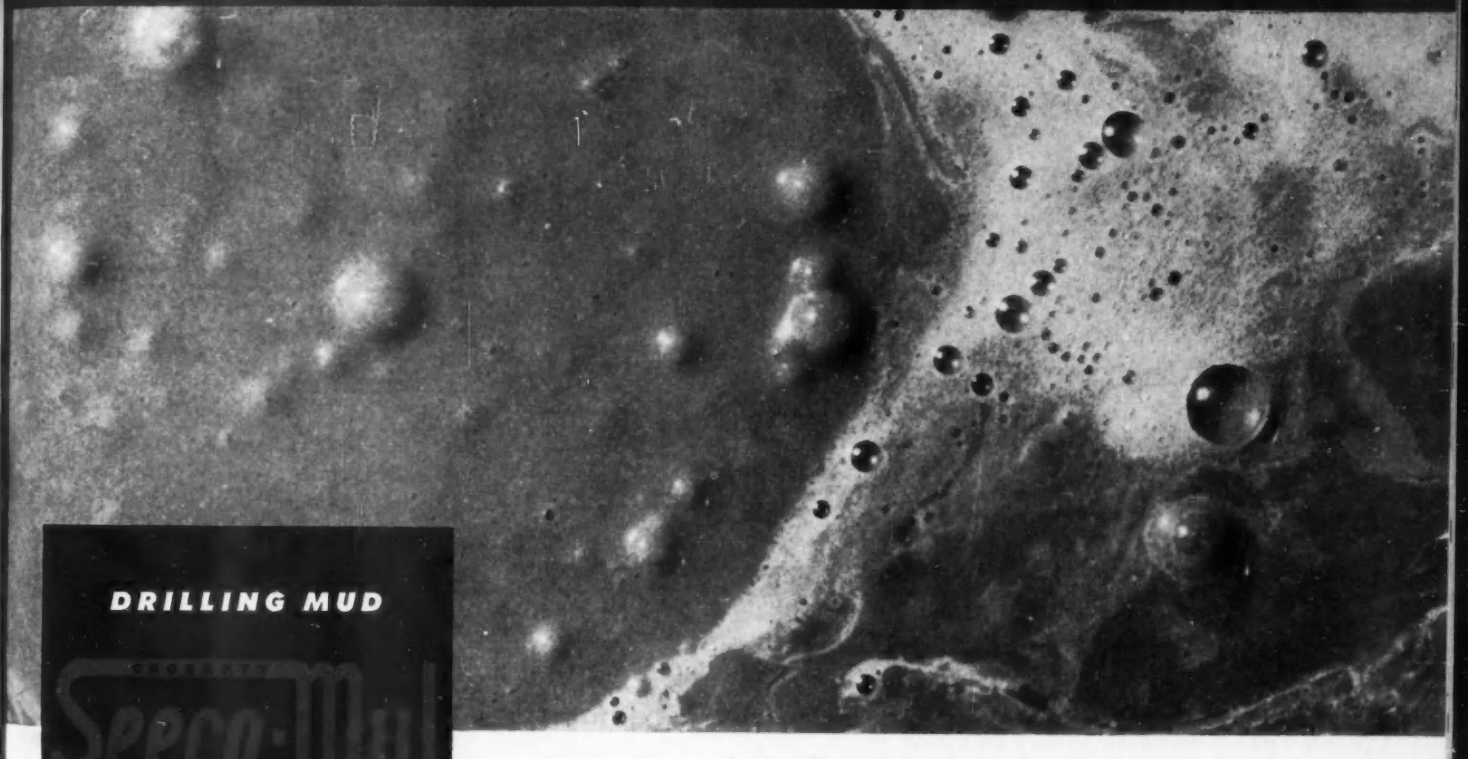
Mobile air drilling equipment is now available to the operator during the time in which it could be most beneficially used on the well for drilling or completion purposes. Air drilling engineers are developing means of extending the practical use of air drilling by combating water with the use of chemicals. Ways to expedite the changing of drilling fluid from air to mud and back to air during the drilling of a well are being studied. Producing companies are becoming increasingly aware of the possibility of air drilling developing reserves where production would be impossible under normal methods of drilling.

ACKNOWLEDGMENT

The authors are indebted to the management of the El Paso Natural Gas Company for the privilege of compiling this data and publishing this report.

—**The End**

makes a good mud better . . . and cost less



DRILLING MUD

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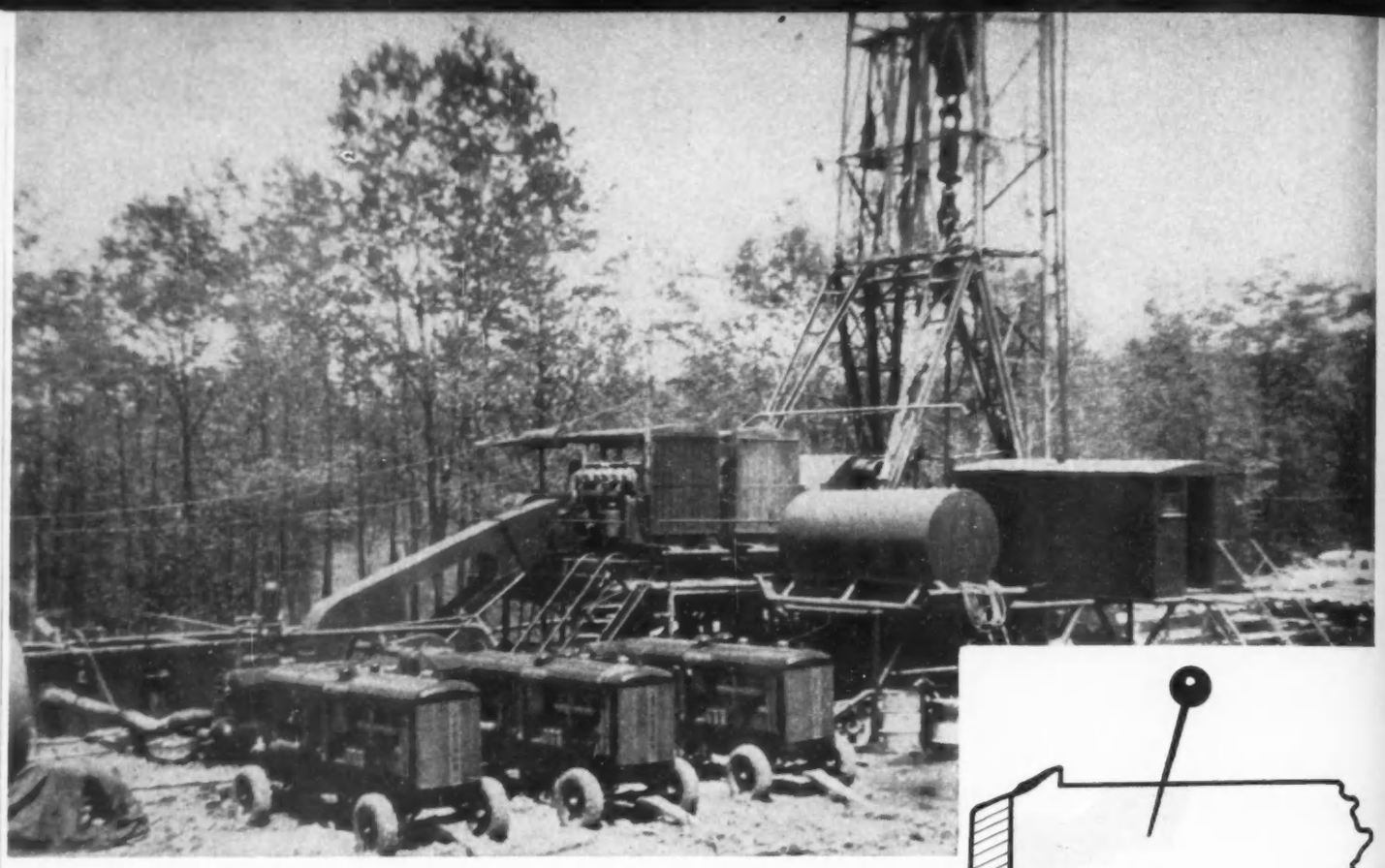
Seeco-Mul is a dry, powdered compound of abietic, linoleic, and oleic acids, wood tannins, and lignins. It effectively disperses the oil content of emulsion muds which accounts for its outstanding properties of maintaining low filtration rates and good wall building characteristics. Emulsion muds containing Seeco-Mul make hole faster and better because drill stem torque is reduced, surface tension is reduced, the bit stays cleaner and better lubricated, and sloughing is appreciably retarded. Seeco-Mul is also exceptionally stable in muds which tend to solidify at high temperatures. Any qualified engineer can use Seeco-Mul without special equipment or special instruction. It is packaged in sturdy, moisture-proof 50-pound sacks which are convenient to handle around the rig.

In many fields—one in the Corpus Christi area, for example—Seeco-Mul has reduced mud costs and rig time by as much as one-half over ordinary muds. Using a Seeco-Mul emulsion mud probably will do as much for your drilling programs, too. Ask your mud dealer for more particulars, or write to us. We'll be glad to send you complete information without obligation. Crossett Chemical Company Division of The Crossett Company, Crossett, Arkansas.

EMULSION MUDS . . . LOW WATER LOSS • HIGH DRILLING RATE • LOWER MUD COSTS • "MAKES A GOOD MUD BETTER"



GREAT STRIDES HAVE BEEN MADE in air drilling in Pennsylvania. Shown here are three 600 cubic feet per minute diesel portable air compressors on location. The compressor hookup shown permits a total delivery of 1800 cubic feet per minute at 100 pounds per square inch. Units are set for 200 psi operation.

IN PENNSYLVANIA

Lost Circulation and Completion Problems Eased

Great strides have been made in combatting these bugaboos of the Appalachian Basin.

By H. J. MAGNER, Delta Drilling Company, Bradford, Penn.

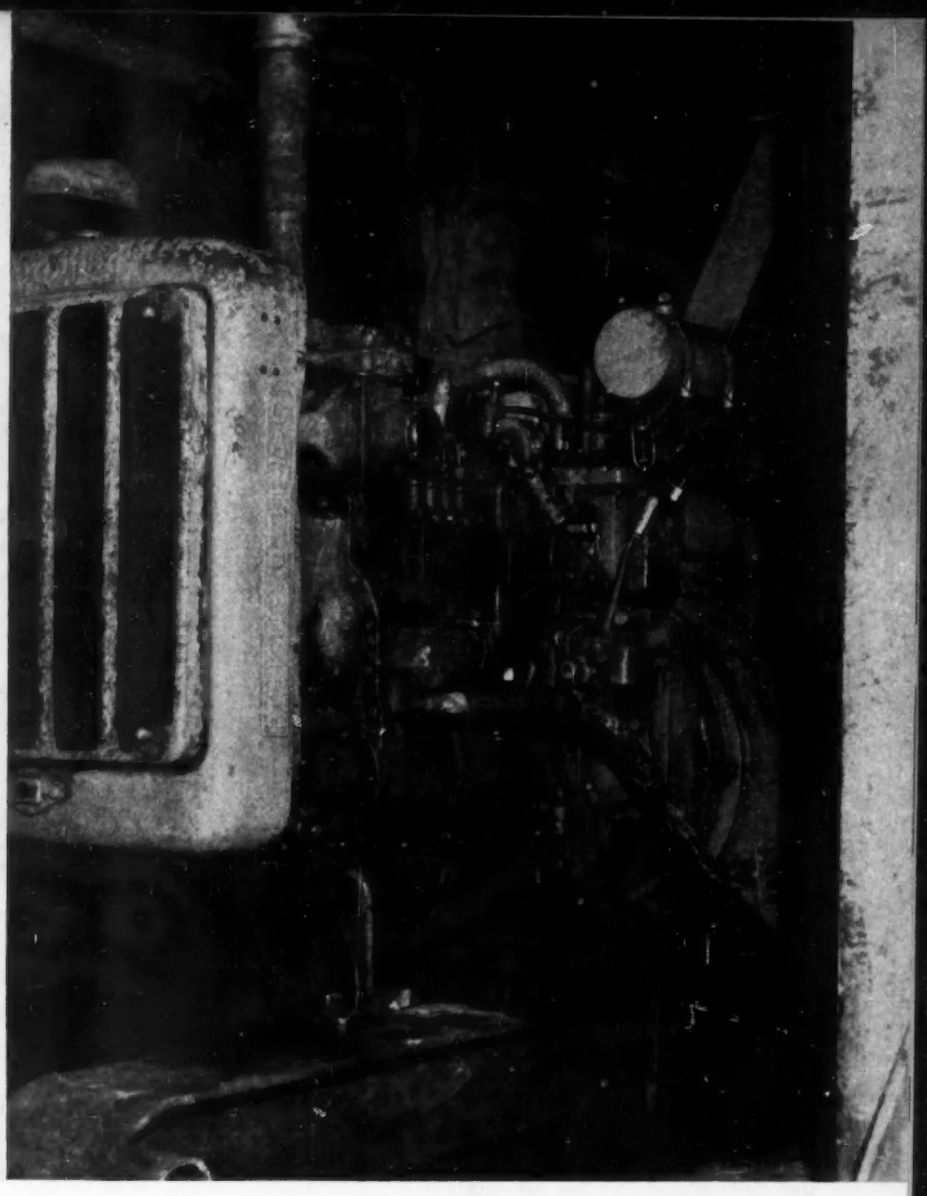
THE DISCOVERY of the Leidy Gas Fields in Clinton County, Pennsylvania, brought rotary drilling to the limelight in the Appalachian Basin. Prior to 1952, the majority of oil and gas wells drilled in this sector utilized cable tool methods. As rotary contractors became familiar with the drilling operations in this new area, penetration rates increased and well costs dropped. However, excessive bottomhole pressures in the gas horizon forced the use of heavy and expensive drilling fluids in completion operations and loss of circulation while drilling surface holes was a problem. To combat this, air drilling operations were employed in March, 1954. Since that time great strides have been made in the use of air and, subsequently, gas drilling.

Rat Hole and Surface Hole. When air was initially used to drill the rat hole, it met with some degree of success. Six hours were required to drill this hole as compared to 24 hours on an offset well. Cutting sizes up to one-half inch in diameter were blown from the 8¾-inch hole being drilled through hard sand rock. Subsequent operations have proven the air to be most effective on the rat hole.

Surface Water Blown from the Hole. Two 600 cubic feet compressors, with an operating pressure of 100 pounds, were initially employed to drill the 12¼-inch surface hole. The penetration rate was only comparable to fluid, probably because of volume shortage, but this experiment failed when excessive surface waters were encountered at 200 feet and prevented additional drilling with air. A subsequent surface hole employing three 600 cubic feet compressors, with 100 pounds pressure, was able to penetrate to a depth of 410 feet at a very rapid rate of penetration before surface waters again overcame the air. On this well it was ascertained that drilling could continue so long

METER READS: 20797 HOURS

TOOLPUSHER SAYS: *"CAN'T BE BEAT"*



"Long life" and "dependability" take on real meaning for the Cat* Electric Set on this rig in Edmonton, Alberta. Particularly after you read the hour meter or listen to the comments of G. Williams, toolpusher for the owner, Commonwealth Drilling Co.

When the picture was taken the meter showed *20,797 hours* of steady, around-the-clock power produced by this Caterpillar Electric Set. And life has just begun. These big yellow diesels are capable of piling up 100 thousand hours and more!

"This Caterpillar Engine can't be beat for this kind of work and under these conditions," said Mr. Williams. "We're completely satisfied."

The D3400 provides power for rig lighting, water pump, shale shaker, electric heaters in the dog-house and substructure. The entire setup depends on this single engine, which has worked steadily through the years in Alberta's below-zero cold, and heat in excess of 96 degrees.

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In these inflationary days, you get real economy by standardizing on rugged Caterpillar Oilfield Engines. Operators and mechanics become familiar with one make. Parts inventory can be eliminated. And you get quick, reliable one-stop field service from *one* dealer—day or night, anywhere.

Call your dealer and let him show you proof of performance. And when you repower or buy new equipment, specify Caterpillar Oilfield Engines.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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THIS GAS 'PIPE ORGAN' is an added safety precaution during drilling-in operations. Seven-inch nipples welded upright into the long flare line allow the gas to be burned upward. A two-inch pilot line insures that all gas is burned.

as the entire amount of fluid coming into the well could be blown off along with the cuttings. The next surface hole drilled with air used three 600 cubic feet compressors, with 200 pounds pressure. This hole was successfully drilled to the casing setting depth of 710 feet. The penetration rate of 10 feet per hour was quite good by comparison; the surface waters were blown from the hole along with the cuttings throughout the entire drilling period.

Higher Pressure Desired. Although only a few air surface holes have been drilled thus far, it appears that most of the difficulties can be adequately met. It is heartening to know that surface waters can be discharged from the hole and increased penetration achieved at the same time. It does appear that a minimum of 200 pounds of pressure is necessary to drill to approximately 700 feet with the hole full of fluid. Once the fluid in the hole has been aerated, the pressure requirements are less in order to keep the hole blown clean. A minimum of 2400 cubic feet per minute of air should be used in drilling a 12¼-inch hole. Increased experience using air should result in a further reduction in drilling time, and in all probability an increase in bit life.

Small amounts of water in the surface hole has caused a "balling-up" of the shales; water can be added to the hole to reduce the solids to liquids and thence be blown out by the air.

Reverse circulation is a possibility in air surface holes since it would reduce the minimum air requirements extensively; this procedure has not been tried in this area, however.

Air drilling under surface to producing horizon

When the initial surface hole failed to produce results with the air drilling, the method was extended to the hole drilled beneath the surface pipe to the Oriskany gas pay horizon. The success was immediate, using the same two 600 cubic feet compressors, although another compressor was added on later wells. Penetration rates were almost doubled, bit life was increased, and the number of bits were greatly reduced. Since this initial venture, improvements have been made and are reflected in Table 1.

Table 1 clearly reflects the reduction of time and cost in drilling holes from under surface to the pay horizon. However, the change to air from fluid has not been without its problems. It was soon learned that the rig was under greater stress due to the movement of the pipe in a dry hole. Eight lines were strung instead of the usual six. Periodic checks are made of the drill pipe and tool joint wear, but no appreciable reduction in size has been noted. Perhaps this can be attributed to the prevalence of limes and shales in the formations drilled and the general absence of sand stones. An almost perfectly true hole was reflected by caliper surveys, even in the softest formations. Some reaming has been required where bits are run to the point where they become out of gage.

With fluid, 15 drill collars were normally employed and it was thought that an increase in this number would result in better penetration. However, with air, the 15 collars were more than adequate; little difference was noted in penetration rates between the range of 20,000 and 30,000 pounds on the bit.

Crooked Holes Prevalent in Alternating Formations. The air hole tended to deviate quite rapidly in certain formations which had hard and soft zones intermittently. This situation has been controlled somewhat by taking off the drill collars, using a four-cone or two-cone bit, reducing the weight on bottom, and increasing the rotary speed. Fishing jobs and stuck pipe have been satisfactorily conquered with air. The common cause for stuck pipe is that the cuttings fall around the pipe and the bit at the bottom of the hole. Several hours were required to work the pipe sufficiently to allow the air to loosen the cuttings in the tight place, on occasions. There are no indications of sloughing formations in these holes.

Water Zone Successfully Squeezed. On one occasion a small amount of water was encountered below the surface string. Unsuccessful attempts were made to blow this down and dry up the formation. However, a satisfactory squeeze job was performed and the well was drilled to its total depth with air, after the squeeze.

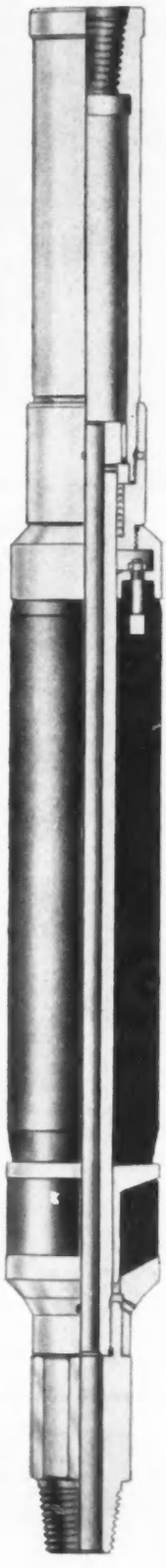
In one shale horizon, the penetration rates are so great that the compressor volume and pressure are not sufficient to keep the hole completely blown down. It is not uncommon to require 15 minutes to drill 30 feet and require an additional 15 minutes to clean the hole.

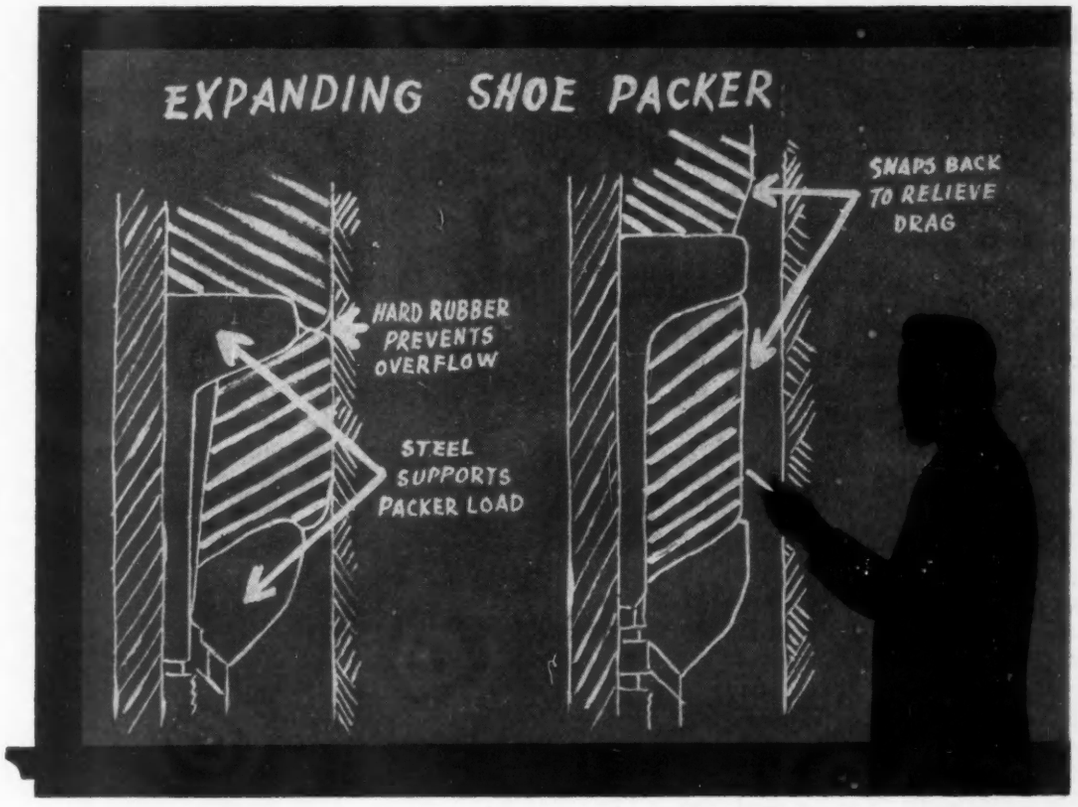
Gas Blowouts. On three occasions, gas blowouts have been encountered in shale pockets above the pay hori-

TABLE 1

Fluid/Air Comparison of Representative Wells Drilled in Elk County, Pennsylvania

WELL	Number 8¾" Bits	Drilling Hours	Feet Drilled	Average Ft. per Bit	Rate Pent. Ft./Hr.
FLUID DRILLED:					
A	26	358½	5454	210	15.2
B	32	320¼	5503	172	17.2
C	39	347½	5271	135	15.2
Average Fluid	32	342	5409	169	15.8
AIR DRILLED:					
D	33	230	6415	194	27.9
E	28	177½	6391	228	36.0
F	19	160	5301	279	33.0
Average Air	27	189	6036	223	31.9





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The assembly maintains maximum clearance going in and coming out of the hole, relieving drag by rubber or metallic parts. It decreases jarring and pulling needed to release packer and reduces number of misruns in oversized holes.

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zon. These are normally quite damaging to cable tool operators, but are of little consequence in air drilling. There is, of course, the hazard of an air-gas explosive mixture, but this has not been encountered as yet.

Various Type Bits and Reamers Used. Hard formation, short-toothed bits have shown the best results, probably due to the smaller cuttings produced which can be blown from the hole easier and quicker. Too, these bits hold gage better and make more footage.

A recent experiment, resulting from experiences drilling-in, was made whereby a tungsten carbide "knobby" rock bit was used in the harder section of the hole. The initial result was successful in that a slightly increased rate of penetration was achieved, and the bit drilled the equivalent amount of hole that seven bits drilled on two comparative wells. The net result was a savings in time, cost, and a reduction of round trips.

Reamers have been tried once with no apparent improvement in bit life reflected. It was learned that they tended to stick the pipe in soft digging, due to a packing of the cuttings about the reamer as they were blown from the hole.

Adequate Return Velocities Needed. Many of those who have worked with air have generally agreed that a return velocity of 3000 feet per minute in the annulus is necessary for excellent penetration rates. Further experience will bear out the validity of this opinion; but it would appear that a maximum return velocity will be reached at a point where the additional cost of added volume will outweigh any improved penetration. It is felt that the 3000 foot per minute rate does keep the bit entirely free from its cuttings. This appears to be the biggest asset of air over fluid. By comparison, a return velocity of 180 feet per minute for fluid is considered quite good.

The pressure of the air is believed to have a great influence on the ultimate completion of a hole. Additional pressure is advantageous where waters would be encountered, in fishing jobs where the pipe is stuck, and in soft digging the increased pressure assists in lifting larger volumes of formation from the hole. Deeper drilling with air should require greater surface pressures due to the pressure loss through the various restrictions from the compressors to the bit.

It seems apparent that hookups should be made in a manner so as to avoid restrictions. Most compressors build up pressure to overcome these restrictions, but a resultant volume decrease and fuel increase occurs.

Rotating Drilling Head Used. A rotating drilling head is used on top of the blowout preventer to eliminate dust around the rig; the cuttings are discharged some 200 feet to 300 feet away through a seven-inch line. Since these locations are in remote areas, little has been done to stop the dusty condition. It is felt the addition of sufficient water to the discharge line will reduce the dust to a satisfactory minimum.

At the present time three 600 cubic feet portable compressors are being used. However, consideration is being given to installing a stationary unit capable of producing approximately this same volume with a pressure maximum of 200 pounds. This permanent unit would be pulled from the pump drive without alteration to the motor speed or compounding system, and would allow for the interchange of compressors and pumps.

Under Surface Bit Record of Delta's Best Mud Drilled Well in Benzette Pennsylvania Field

BIT No.	8¾" Type	FOOTAGE From	FOOTAGE To	Feet per Bit	Hours	Mins.	Feet per Hour Penetration Rate
1	A	884	1076	192	11	57	16.0
2	A	1076	1255	179	10	01	17.9
3	A	1255	1360	105	6	40	15.75
4	A	1360	1450	90	4	15	21.17
5	A	1450	1553	103	6	41	15.45
6	A	1553	1655	102	5	57	17.00
7	A	1655	1755	100	6	12	16.15
8	A	1755	1881	126	6	18	20.16
9	A	1881	2037	156	8	17	18.90
10	A	2037	2160	123	7	59	15.37
11	A	2160	2339	179	10	36	16.88
12	A	2339	2425	86	5	55	14.55
13	A	2425	2495	70	5	48	12.08
14	B	2495	2600	105	9	53	10.62
15	A	2600	2840	240	12	25	19.35
16	A	2840	2960	120	6	46	17.79
17	A	2960	3064	104	9	23	11.06
18	A	3064	3145	81	6	19	12.85
19	A	3145	3250	105	8	00	13.15
20	C	3250	3343	93	8	21	11.11
21	C	3343	3495	152	11	58	12.68
22	C	3495	3638	143	10	23	13.75
23	C	3638	3830	192	12	01	16.00
24	D	3830	4030	200	10	11	19.65
25	D	4030	4193	163	10	23	15.68
26	E	4193	4302	109	7	29	14.52
27	D	4302	4680	378	18	42	20.20
28	D	4680	4990	310	16	50	18.45
29	D	4990	5647	657	29	03	22.60
30	F	5647	6117	470	21	54	21.42
31	E	6117	6381	264	12	42	20.80

SUMMARY DRILLING DATA

19⅓ Over-all Days
320:12 Drilling Hours on Bottom
177.5 Feet per Bit
17.15 Feet per Hour Penetration

TYPE BITS:
A—Hard Abrasive Formation—Jet Type
B—Hard Abrasive Formation—Maximum Resistance to Gage Wear—Jet Type
C—Hard Abrasive Formation
D—Medium Hard Formation—Jet Type
E—Medium Hard Formation—Jet Type, for Shales and Limestones
F—Unconsolidated, Medium Rock Formation—Jet Type

Under Surface Bit Record of Delta's Best Air Drilled Well in Benezette Pennsylvania Field

BIT No.	8¾" Type	FOOTAGE From	FOOTAGE To	Feet per Bit	Hours	Mins.	Feet per Hour Penetration Rate
1	A	607	880	273	10	20	26.76
2	B_1	880	1964	1084	47	26	22.94
3	B_1	1964	3435	1471	56	44	26.06
4	C_1	3435	3752	317	15	49	20.46
5	C_1	3752	3960	208	13	58	15.32
5	C_1	3960	4345	385	20	31	18.96
7	C_1	4345	6160	1815	37	1	48.92

SUMMARY DRILLING DATA

11⅓ Over-all Days
201:49 Drilling Hours on Bottom
793.3 Feet per Bit
30.95 Feet per Hour Penetration

Type Bit:
A—Hard Abrasive Formation
B_1—Tungsten Carbide Insert
C_1—Hard Abrasive Formation

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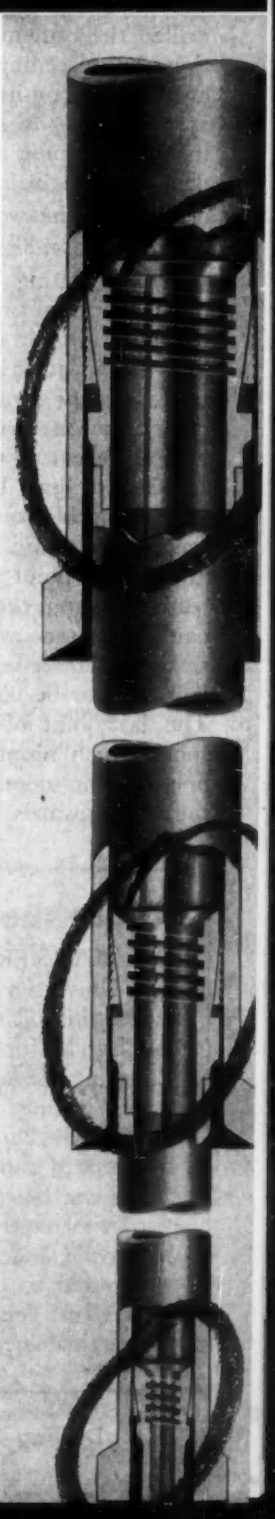
Today's small allowables emphasize the importance of keeping well completions cost at an absolute minimum. The greatest cost reducing factor in well drilling today comes in the use of the *CASING HANGER* which eliminates overlap of casing, thereby saving miles of pipe.

This is nothing new to the Burns Tool Co. For years we've supplied our patented casing hangers to leading oil companies the world over. But there is a technique in building a 100% efficient hanger which will suspend tremendous loads with positive safety — a hanger that will stay where it is set, holding the pipe in perfect alignment with the well bore.

Suspend your oil string in tension and it will not collapse of its own weight — will not buckle or shift position in the well — will not sink into the bottom formation or bend into cavities. Eliminate the hazards of casing contacting the wall of the hole. Perfectly aligned casing is not subject to undue wear from servicing tools. Then too, successful cementing is assured as no time is lost in making up overlapped casing or making up extra surface circulating connections — no danger of frozen casing.

Thousands of Burns casing hangers are in use today. Available in all popular sizes. Prices on request. Check with us direct or consult a Burns distributor.



SLIP DESIGN

Secret of the Burns casing hanger rests on the slips. Instead of the conventional tapered cone used to force slips outward, the Burns patented construction provides specially broached single plane runners on which slips travel with a full 100% backup contact at all positions. No "two point" slip support and no cracked slips but instead a true 100% wedge —the Burns patent.

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Drilling into gas pay with gas

To date, eight gas wells have been completed using natural gas as the drilling medium. In each case, 7-inch casing was set and 3½-inch drill pipe used to drill-in with. Since the gas pay section is relatively thin, 6⅛-inch tungsten carbide bits were used to drill the cherry lime cap rock and the abrasive Oriskany sand gas zone. Approximately 50 feet of hole was drilled in each case. Surprisingly enough, this type bit successfully drilled the cement, plug, and formation, in exceedingly good time. An average drilling-in operation requires approximately 16 hours from the time the cement plug is drilled until the drill pipe is stripped out and laid down, and the well closed in by the master gate valve.

While waiting on long-string cement, the usual procedure is to rig up for the drilling-in operation. A master gate valve with a crosshead tee is attached to the long string casing; the rotary blowout preventer is flanged on top of the master gate valve; and the rotating drilling head is flanged on top of the blowout preventer. A gas flow line is laid from the rotating head to a point approximately 400 feet away from the rig so that the gas can be flared while drilling-in. A small gas line is laid to the end of the flare line to be used as a pilot light. The last joint of the flare line has short 7-inch nipples welded into the line upright to enable the gas to be burned upwards. Added protective measures are also used. On one side of the crosshead tee, the mud pump is attached so that the well could be killed if necessary. The other side of the crosshead tee is hooked into the flare line so that the well can be closed in with the blowout preventer and the gas bled off or by-passed through the flare line, if necessary. The gas which is used to drill-in with is taken from the main gathering lines in the field. Pressures from 400 to 800 pounds can be used; volumes of from 2,000,000 to 4,000,000 cubic feet are used to drill-in with. Since the casing is cemented by using a "balance job," approximately 3000 feet of water remains in the casing prior to drilling-in. With 800 pounds of gas pressure, approximately 900 feet of water in the casing can be blown at one time. The gas is tied into the standpipe at the same place the air compressors hook in; when connections are made, a bleed-off line is tied from the standpipe to the flare line, as an added safety precaution to prevent gas in the rig vicinity.

Normally, there is very little gas around the rig floor at any time during drilling-in operations; what little gas occurs on the floor comes at the time the drill pipe is being stripped out and is not excessive or particularly dangerous.

Some trouble was initially experienced in drying up the hole, but the installation of a gas heater eliminated this difficulty and prevented line freezing. This procedure is also advantageous in the cold winters, which are prevalent in the area. Costwise, this whole procedure is comparable to drilling-in with cable tools. It has further advantages, in that it is quicker, and allows the operator to completely drill through his pay section.

Summary and future prospects

The preceding accomplishments with air and gas as the drilling medium should cause many operators to seriously consider their utilization in future drilling programs. Although it is quite true that excess fluid destroys the effectiveness of air or gas, there are many sections of hole which could be drilled with this medium with a resultant savings in cost. Formations should be studied as to permeability and porosity to determine whether they are devoid of fluids which would hinder air or gas drilling. This medium, of course, should be strongly considered in deep drilling operations, since it can go to greater depths than fluid without the great increase in horsepower at the surface. Too, the air and gas eliminate the redrilling of cuttings, which is probably most prevalent at greater depths. It is probable that many low pressure oil bearing sands can be drilled into with gas. The oil would have to be blown to the surface while drilling-in operations were under way.

Although there is no known experiences to prove it, there is a good possibility that the injection of air to the fluid medium would lighten its weight, increase its return velocity, and therefore, increase the penetration rate. In general, the use of air and gas as a drilling medium is in its infancy. As more operators make use of this medium, more ideas, statistics, and technique improvements will be discovered with the end result being substantial reduction in the cost of drilling rotary holes throughout the world.

—The End

About the Author

H. J. MAGNER graduated from the University of Texas and started his oil field career as a roughneck for Delta Drilling Company. He served in the armed forces during World War II and was discharged in 1946 with the rank of captain. Subsequent to the war he served as assistant district manager for Delta in the Evansville, Ind., district. He was transferred to the Pennsylvania district in February, 1954, as district manager.

There's more yet . . .

Additional information on air and gas drilling will be published in the Drilling Section of your February 1 issue of WORLD OIL.

Following publication of this material reprints of the complete collection of articles will be available.

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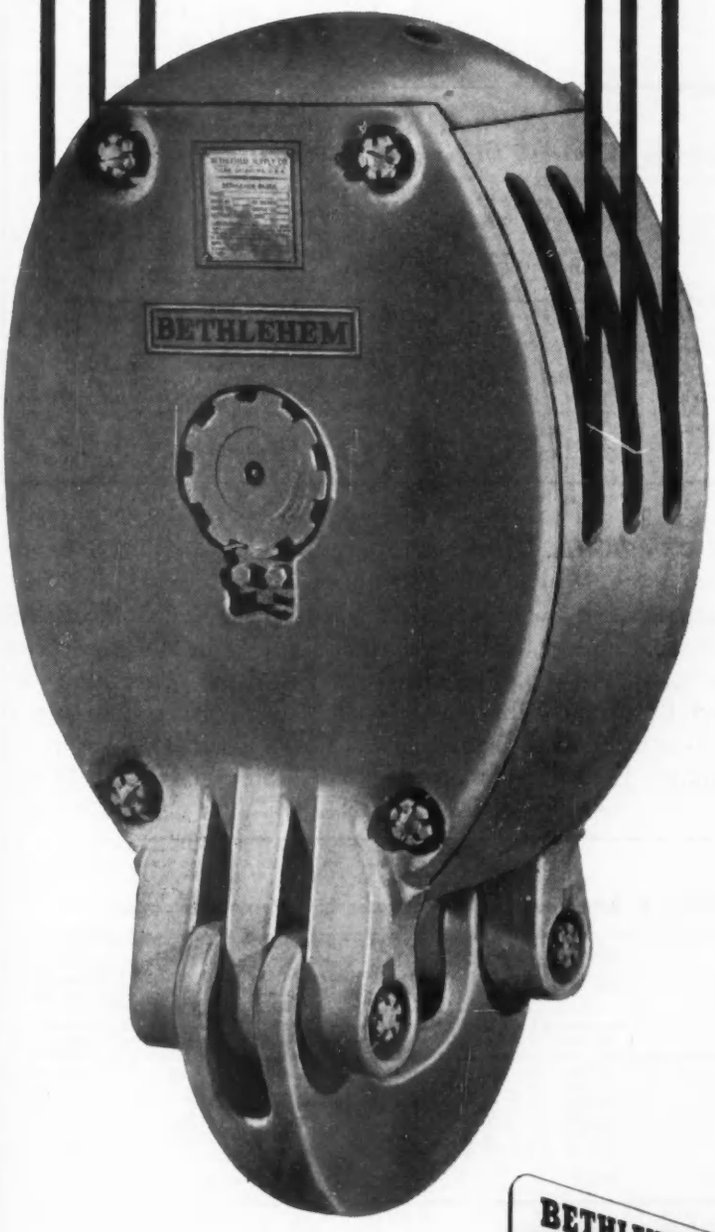
At last! A really stable TRAVELING BLOCK



By this time maybe you're already using Bethlehem's B-line traveling blocks. If so, you know what they mean to your rig in terms of added stability. All that extra weight insures a high "empty" falling speed . . . and it means less deflection when a stand of pipe is leaned against the hook.

But if you haven't yet rigged up with one of the B-series blocks, it's time you looked them over. You can't help noting their heavy side plates, caps, sheaves, and adapters. It's this heavier weight, plus center of gravity below the center pin, that makes the blocks so stable.

There are other features, too. For instance:

The blocks are designed around *big-diameter* center pins. Every sheave is equipped with a two-row tapered roller bearing, and each bearing is individually lubricated from its own fitting.

And here's something everybody likes—the ease of stringing up. With a Bethlehem block, you never have to remove the wire-line guards; a special device within the block makes the line self-guiding.

Care for more details? Phone or write for our latest descriptive bulletin.

Bethlehem B-line traveling blocks are made in four sizes as follows:

		Rating*
B-30	.....	100 tons
B-36	.....	160 "
B-42	.....	250 "
B-55	.....	400 "

**All sizes designed on basis of 4-to-1 (or higher) safety factor as required by A.P.I. Standard No. 8-A for "Rating of Drilling and Production Hoisting Tools."*

BETHLEHEM SUPPLY COMPANY

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West Coast Headquarters: Los Angeles, Calif.
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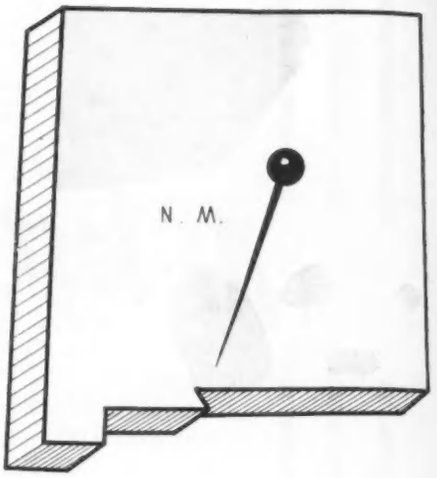
BETHLEHEM STEEL

In addition to drilling equipment and a full range of pumping units, Bethlehem offers Beth-Co-Weld line pipe, Purple Strand wire rope, and a complete variety of sucker rods, fasteners, etc. Ask for these products when equipping your oil-country installations.

IN NEW MEXICO

Air-Drilled Well Compared With Well Drilled With Mud



By **R. D. LEMMONS** and **K. J. BARR,**
Stanolind Oil and Gas Company, Hobbs, New Mexico

Stanolind Oil and Gas Company and Southern Production Company pooled experiences to produce an excellent comparison between air and mud drilling near Cloudcroft, New Mexico.

When Stanolind decided to drill a wildcat well, the Thorn Unit 1 in the foothills of the Sacramento mountain range of Otero County, New Mexico, they faced the prospect of having to combat serious lost circulation from the surface to the basement rock. Furthermore, water was scarce. After consideration of the cost of cable tools versus rotary drilling with air or mud, the drilling program was designed to drill with air to the greatest depth possible.

The hole was successfully drilled with air to 4646 feet for a total cost of $147,866. In order to evaluate these results, figures from a nearby mud drilled well were needed.

The Southern Production Company cooperated by providing drilling records of the nearby Cloudcroft Unit 1 drilled by them. The formations drilled were essentially the same and the size hole drilled on the Cloudcroft Unit was the same or smaller than that drilled by the Thorn Unit.

The charts and graphs shown on these pages tell the story.

Author R. D. Lemmons, formerly with Stanolind Oil and Gas Company in Hobbs, New Mexico, is now associated with Big Three Welding Equipment Company, Inc., Fort Worth.

TABLE 1
Comparison of Average Bit Footages in Different Formations

	Mud Cloudcroft Unit 1		Air Thorn Unit 1		Difference Feet/Bit	Percent Difference Compared To Cloudcroft Unit 1
	Thickness Feet	Feet/Bit	Thickness Feet	Feet/Bit		
San Andres	350	163	611	123	— 40	— 25
Glorieta	30	200	24	480	+280	+140
Yeso	1,240	137	1,315	774	+637	+465
Drinkard	540	204	500	400	+196	+ 96
Abo	250	147	360	180	+ 33	+ 22
Pennsylvanian	1,150	38	1,836	115	+ 77	+203
Total and Over-all Average	3,560	76	4,646	172	+ 96	+126

BIT FOOTAGE COMPARED. Twenty-seven bits were actually used on the Thorn Unit 1 while drilling with air to 4646 feet. On the Cloudcroft Unit 1, 47 bits were actually used to drill to 3560 feet through similar formations. In order to determine the bit savings this would represent, it was necessary to estimate how many bits would have been required if the Thorn Unit were drilled with mud. By assuming the average bit footage to be the same in each formation as it was on the Cloudcroft Unit 1, it appears that 69 bits would have been required. These calculations would indicate a saving of 42 bits.

TABLE 2
Comparison of Average Penetration Rates in Different Formations

	Mud Cloudcroft Unit 1		Air Thorn Unit 1		Difference Feet/Hr.	Percent Difference Compared To Cloudcroft Unit 1
	Rotating Hours	Feet/Hour	Rotating Hours	Feet/Hour		
San Andres	27.25	12.8	101.25	6.0	—6.8	—53.1
Glorieta	2.50	12.0	2.00	12.0	0.0	0.0
Yeso	122.75	10.1	113.25	11.6	+1.5	+14.9
Drinkard	50.75	10.6	38.50	13.0	+2.4	+22.6
Abo	29.00	8.6	48.50	7.4	—1.2	—14.0
Pennsylvanian	448.25	2.6	384.75	4.8	+2.2	+84.6

PENETRATION RATES COMPARED. Assuming that the average penetration rates while drilling with mud on the Thorn Unit 1 would have been the same in each formation as it was on the Cloudcroft Unit 1, 996 rotating hours would have been required to drill to 4646 feet with mud. With air only 688 hours rotating time were required. These penetration rates were obtained with bit weights less than half those normally used while drilling with mud.

TABLE 3

Cost Comparison of Drilling With Air Versus Drilling With Mud on Thorn Unit 1

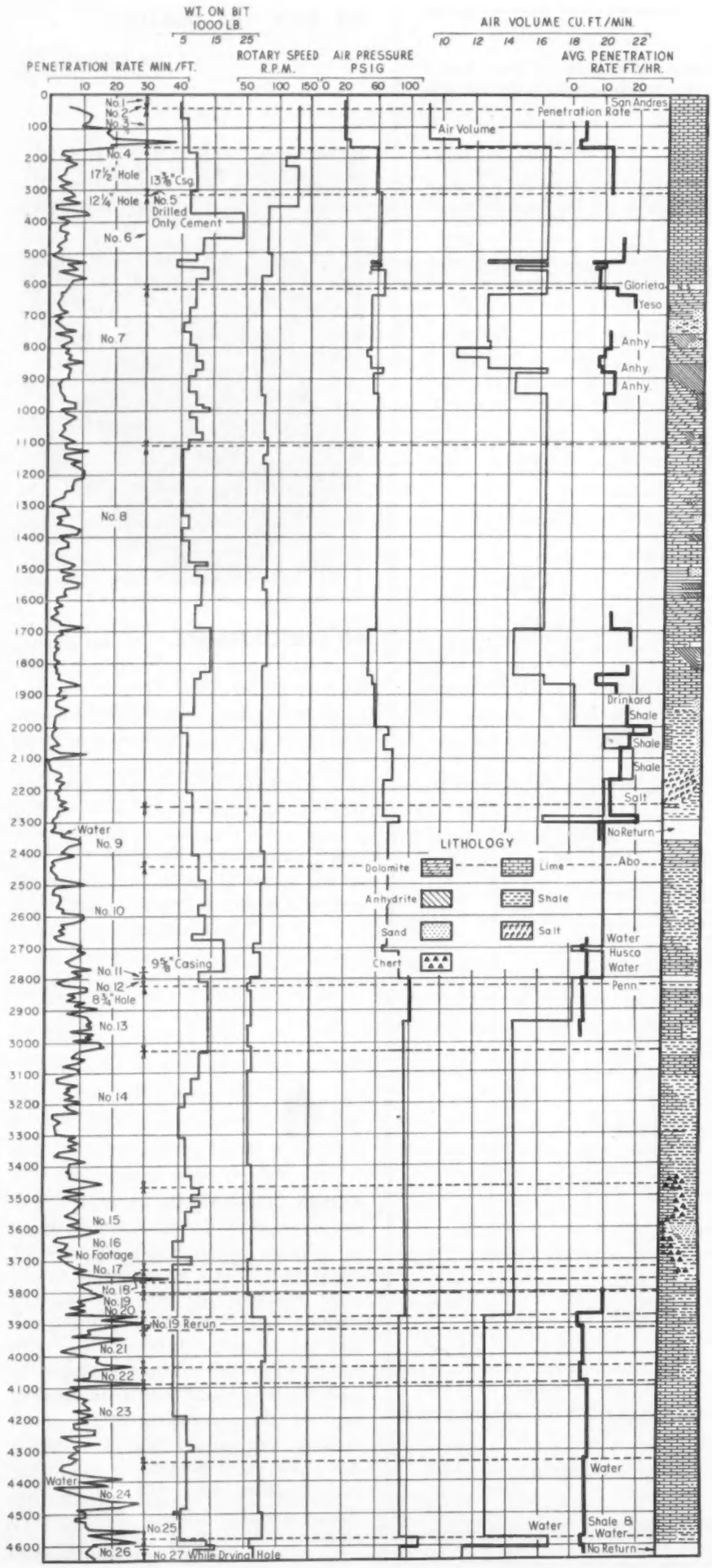
Includes only costs that would vary between the two methods of drilling assuming no lost circulation while drilling with mud.

	Cost of Drilling With Air on Thorn Unit 1		Estimated Cost of Drilling with Mud for Thorn Unit 1 Based on Penetration Rates and Bit Life on Cloudcroft Unit 1	
		Total Cost		Total Cost
1. Moving in Costs Same except for moving in compressors		$ 1,401		
2. Rigging up Costs A. Day time same except for rigging up compressors	24 hours	625		
B. Welding costs for air drilling		500		
3. Drilling Surface Hole (0′ to 305′) A. Bits (17½″ at $650) (Does not include reamers and cutters)	4 bits	2,600	2 bits	$ 1,300
B. Day time ($625/day) ($26.042 hr.) Rotating time	69 hours	1,797	24 hours	625
Trip time (1 hr./trip)	4 hours	104	2 hours	52
Revised head for air drilling	56 hours	1,458		
Freeing bit and reamer cones	14 hours	364		
Installing additional compressors	7 hours	182		
4. Surface Pipe 13⅜″ (Same for pipe and cement assuming no lost circulation)				
5. Intermediate Hole (305′ to 2803′) A. Bits (12¼″ at $260 each)	7 bits	1,820	(Average 138 ft./bit) 18 bits	4,680
B. Day time Rotating time	237 hours	6,172	(Average 9.4 ft./bit) 265 hours	6,901
Trip time (3 hours per trip)	21 hours	547	54 hours	1,406
Additional time circulating for Totco surveys, trips, running casing	18 hours	469		
Revising air lines, cooling system, compressors	37 hours	964		
Replacing rubbers in head	6 hours	156		
Unloading hole after running casing	6 hours	156		
Time lost due to water entry in hole. (Stuck pipe, trips to unplug bits, circulating to dry hole, etc.)	49 hours	1,276		
6. Intermediate Casing (9⅝″) Same for pipe and cement with both methods. 8¾″ hole (2803′ to 4646′) A. Bits (8¾″ at $168 each)	16 bits	2,688	49 bits	8,232
B. Daytime Rotating time	382 hours	9,948	707 hours	18,412
Trip time (4 hours per trip)	64 hours	1,667	196 hours	5,104
Additional time circulating for trips	9 hours	234		
Revising air lines, compressors, etc.	8 hours	208		
Replacing rubbers in head	2 hours	52		
Unloading hole after running casing	22 hours	573		
Time lost due to water in hole. (Stuck pipe, trips to unplug bits and check water, circulating to dry hole, reaming due to mud buildup, additional circulating to dry hole before running 7⅝″ casing, revising air set-up because of water in hole)	255 hours	6,641		
7. Intermediate Casing (7⅝″) (Would not have been required if drilled with mud. Assuming no casing failure) A. Casing 7⅝″	4646′	11,355		
B. Day time, running casing and WOC and drilling plugs	96 hours	2,500		
C. Cement and services (150 sacks, 1 truck)		500		
8. Compressor Costs A. Compressor rental (Manifold and air lines included)		18,288		
B. Fuel		2,455		
C. Maintenance men		3,107		
9. Fuel for Rig (Mud pumps increased requirements)		6,142	52 days	7,000
10. Water at $0.36/barrel (300 bbl./day mud drilling)		1,857	52 days	5,616
11. Well Head Rental		1,460		
A. 6 rubbers at $175 each		1,050		
12. Mud Cost (Gel chemical mud $1/ft.)		735	4646′	4,646
13. Drill Stem Tests (None required for air drilling)				3,200
TOTAL	.....	$92,051	.....	$67,174

BIT PERFORMANCE. This bit drilled from 1100 feet to 2250 feet in 94¾ hours rotating time. Despite the exceptionally long run, both bearings and teeth were in excellent condition when the bit was pulled. The bit was still averaging four minutes per foot when it was pulled. Bits used on the Thorn Unit I averaged 126 percent more footage per bit than bits run in the same formation of the mud-drilled Cloudcroft Unit 1.

COSTS COMPARED. In an effort to get a meaningful comparison between air drilling and mud drilling costs for the Thorn Unit 1, all costs that would vary between the two methods of drilling were tabulated assuming no lost circulation while drilling with mud. While air drilling appeared to cost $24,877 more than mud according to this comparison, the mud drilled well would almost certainly have cost more because of lost circulation which cost $91,400 on the Cloudcroft Unit 1.

Continued



AIR AND GAS DRILLING

Here's what air drilling cost . . .

(Above comparable mud drilling costs)

$26,876 for compressors (rigging, rental, fuel and maintenance).

$14,355 for intermediate string of 4646 feet of casing which would not have been required for a mud drilled well.

$7917 time lost combating water in hole.

. . . plus miscellaneous expenses listed in Table 3 (note that certain rigging and revision costs would not be repeated on later wells).

Here's what air drilling saved . . .

42 bits (27 instead of estimated 69).

308 hours rotating time (688 instead of 996).

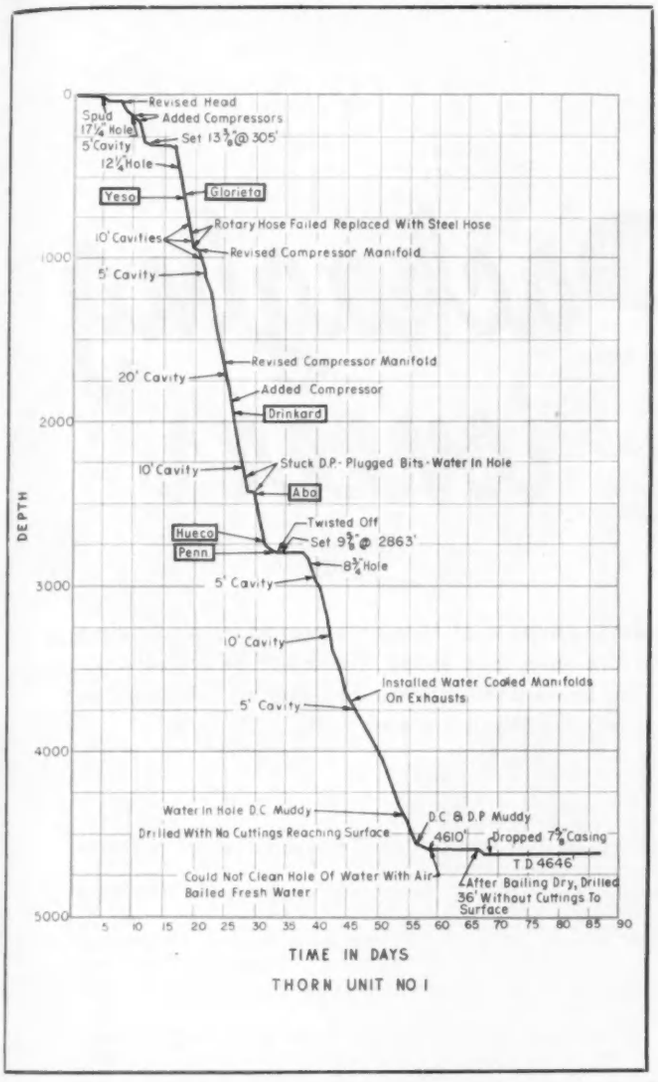
Thousands of dollars in lost circulation costs ($3000 on the Thorn Unit 1, $91,400 on Cloudcroft Unit 1).

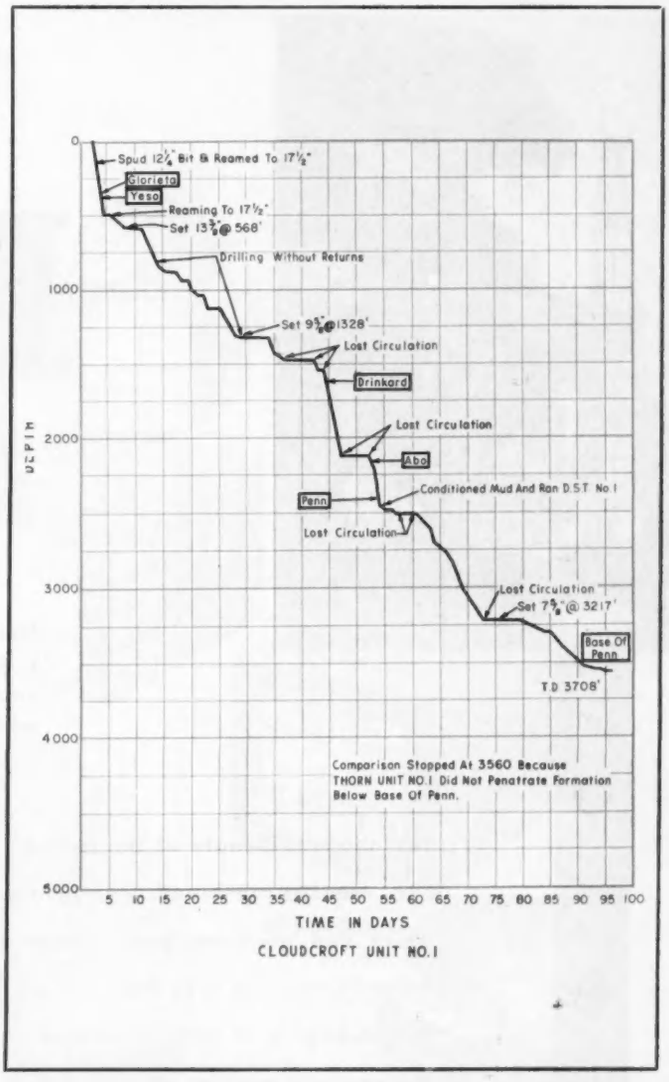
$3759 in water costs (not counting lost circulation water costs).

. . . plus miscellaneous mud drilling expenses listed in Table 3.

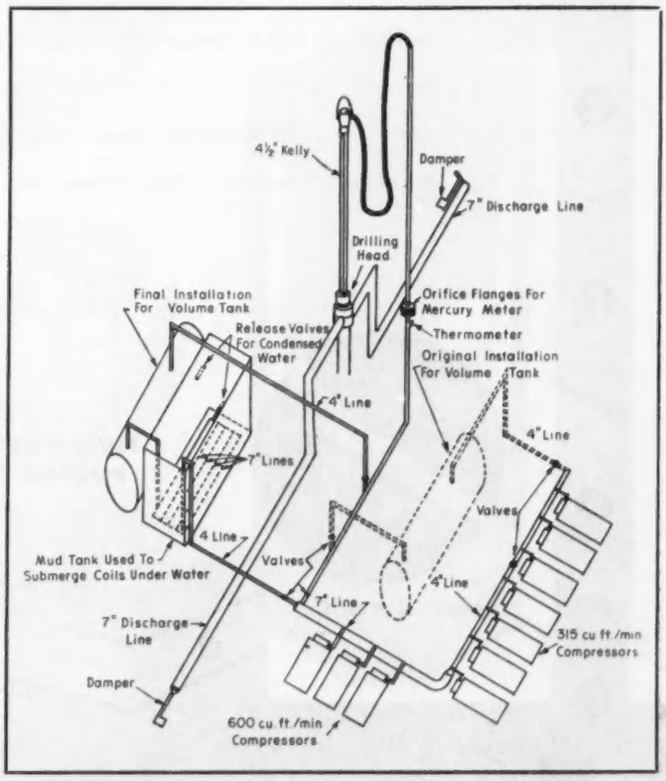
•

VITAL STATISTICS of the air drilling experiment conducted by Stanolind Oil & Gas Company on Thorn Unit 1 in Otero County, New Mexico. Footage per bit and penetration rates were generally satisfactory after compressors were added at 159 feet to bring actual air volume to 1650 cfm. Additional compressors were added at 1880 feet and 2005 feet to bring the actual capacity to 2400 cfm. Satisfactory penetration rates were maintained with weights generally less than half those normally used for mud drilling. These light weights minimized crooked hole problems and resulted in long bit bearing life.



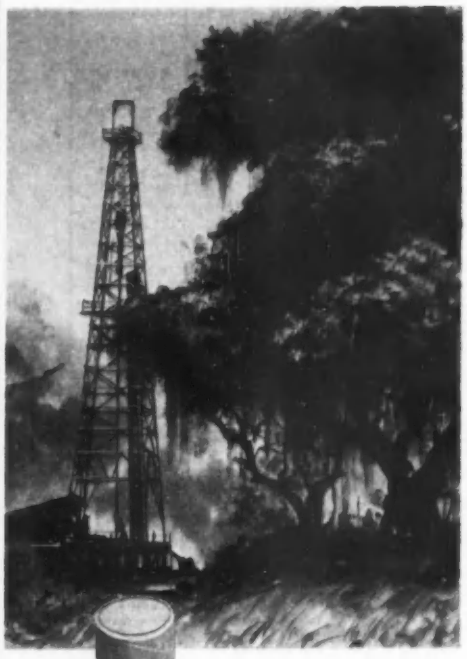


THESE LOGS OF DRILLING OPERATIONS give a dramatic comparison of drilling progress on the two wells. Drilling rates with air were generally faster (after sufficient air volume was obtained) than mud drilling rates through the same formations. Notice that 1242 hours, or 31 percent of the total time spent drilling with rotary tools on the Cloudcroft Unit 1 was spent combating lost circulation. The total cost of lost circulation was $91,400 on this well including charges for rig time while it was only $3000 on the air drilled Thorn Unit 1. Lost circulation expense on Thorn Unit 1 was incurred while attempting to cement the 305-foot surface casing string.



AIR DRILLING FACILITIES (right) as they existed after modifications were completed. Modifications included the addition of seven compressors and the aftercooler after drilling was started. Compressors were added because the initial air volume was too low for satisfactory penetration rates. The aftercooler was added because the high air temperatures of 210° F. caused rotary hose to fail. Cooling system shown reduced the air temperature to 160° F. Two 7-inch, 150-foot discharge lines were run to opposite sides of the rig and each line was fitted with a damper. The "up-wind" damper was kept closed to minimize dust problem on the rig.

Continued on Page 130



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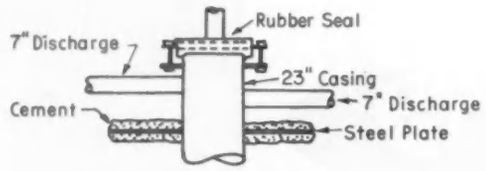
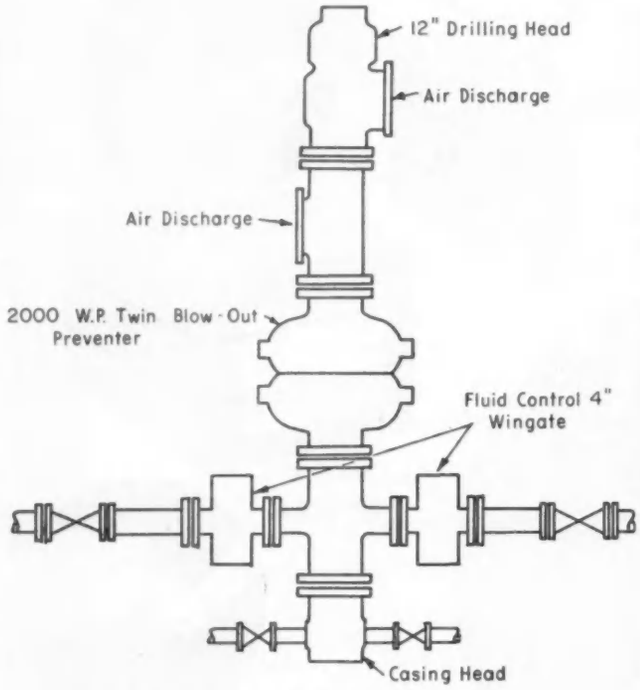


REVISED WELLHEAD ASSEMBLY



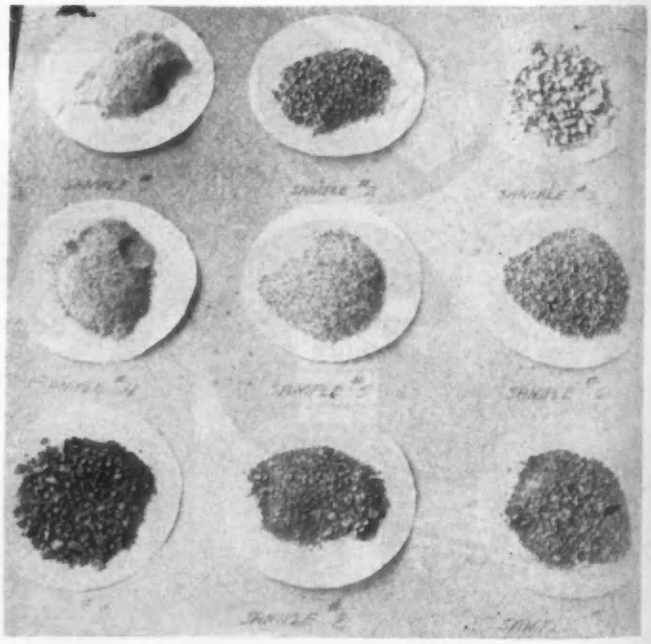
BLOWOUT PREVENTER ASSEMBLY FOR AIR DRILLING

REVISED WELLHEAD ASSEMBLY was used in drilling surface hole between 35 feet and 305 feet after the first drilling head, a unit consisting of two oil drums welded together with a split plate and drill pipe wiper to seal the top of the drums, had leaked so badly that working conditions on the rig floor were unbearable.

THIS BLOWOUT PREVENTER assembly with rotating type drilling head was used below surface pipe from 305 feet to 4646 feet. Notice that an extra spool is used to provide an extra discharge line. In practice, the "down-wind" discharge line was used and the "up-wind" line was closed with a damper.

Samples of cuttings taken at different intervals on Thorn Unit 1

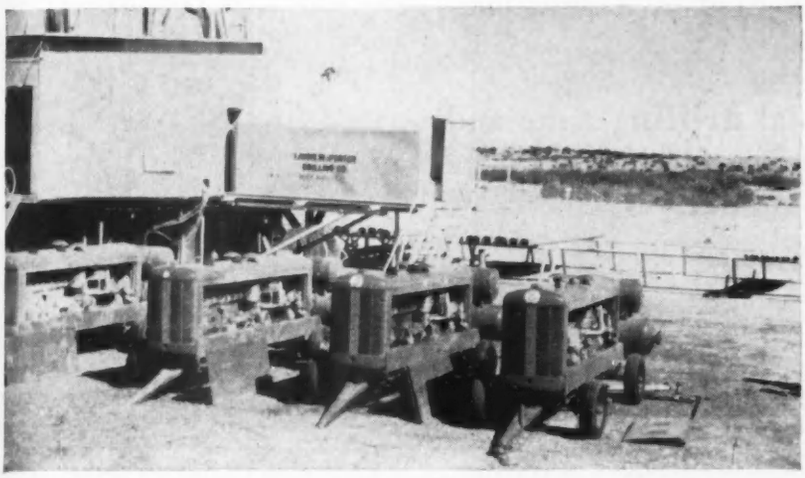
	Interval	Hole Size	Volume of Air, Cu. Ft./Min.	Formation
Sample 1...	130'- 140'	17½"	910	Lime
Sample 2...	160'- 165'	17½"	1100	Lime
Sample 3...	345'- 350'	12¼"	1650	Lime
Sample 4...	930'- 940'	12¼"	1460	Dolomite and Shale
Sample 5...	2100'-2110'	12¼"	2200	Shale and Sand
Sample 6...	2400'-2405'	12¼"	2030	Dolomite
Sample 7...	2920'-2930'	8¾"	2030	Lime
Sample 8...	3220'-3230'	8¾"	1470	Lime and Shale
Sample 9...	4240'-4250'	8¾"	1290	Lime and Shale



—The End

Here is how...

contractors doubled their drilling speed and eliminated half their trips



Four SCHRAMM Model 600 diesel engine driven portable air compressors, pumping into a manifold, furnished air for a drilling operation. No special adjustments or controls were required—the SCHRAMM PNEUMASTAT controls the speed of each engine according to the demand for air, so each compressor carries its rightful share of the load.

An 1800 c.f.m. SCHRAMM air compressor outfit is driven from the mud pump of the drill rig. Each compressor is independently driven through a clutch and V belts, so 600, 1200 or 1800 c.f.m. of compressed air can be had, as required. This large outfit requires no foundation, and no running water.

SCHRAMM compressors can be operated continuously at any pressure from 10 p.s.i.g. to 125 p.s.i.g., and intermittently up to 200 p.s.i.g. The 600 c.f.m. unit is available with diesel engine drive, natural gas engine drive and for V belt drive. Other sizes are 125, 210 and 315 c.f.m. actual free air delivery, with gasoline or diesel engine drive or for V belt drive.

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IN WEST TEXAS

Here Are the Findings From Four Wells

The author points out that certain findings emerged from air and gas drilling experiments in West Texas. These findings are presented as an aid to those considering air drilling.

1. Satisfactory penetration rates were obtained using return air velocities as low as 2000 feet per minute.
2. Air pressure of 125 pounds per square inch is sufficient for most drilling unless water is encountered.
3. A simple drip is recommended to allow water to condense from the compressed air before it goes to the stand pipe. This prevents trouble from water condensing on the drill pipe.
4. Conventional rock bits and chert bits gave excellent results. Drilling weights used were generally about half those used for mud drilling.
5. Diamond reamers can be run to indicate when the rock bits are out-of-gage. The reamer will take weight, reducing the drilling rate and indicating that the bit is worn. Before this practice was started, considerable time was spent reaming out-of-gage hole because there was no indication when a bit was worn. The rate of penetration does not seem to decrease with bit wear.
6. Higher pressures, higher volumes and higher temperature air might dry up some formations so drilling could continue where it would not be possible with 125 psi air.
7. No suitable methods of handling water flows and caving formations were developed during these experiments.
8. Drastic reductions in drilling time and costs are possible.

- **Both penetration rates and footage per bit were increased when air or gas was used as drilling medium.**
- **Total drilling time and total cost per hole were reduced.**

By EARL BRUNO, District Production Superintendent
Ada Oil Company, Midland, Texas

AIR AND GAS DRILLING will reduce footage costs substantially in selected areas through increased drilling rate. With this advantage, operators will be able to develop marginal properties which they previously were unable to develop because of high drilling costs.

Air drilling has been successfully used in drilling surface holes where lost circulation is a problem. It has been used to drill into and through low pressure gas zones and complete wells under pressure without ever mudding up. The most important use of this process is simply making hole at an increased drilling rate.

The equipment necessary to convert a conventional rotary rig to an air-drilling rig consists of the following (see Figure 1):

1. A simple valve manifold is welded in the stand pipe on the derrick floor. This controls the supply of air and the direction of flow through either the regular circulation, reverse circulation, or the bleedoff line.
2. A circulating head is placed on top of the regular blowout equipment to effect a packoff around the kelly and prevents the returns from blowing through the rotary. Sixty RPM maximum rotary speed is recommended because of high maintenance cost on rotating head at higher RPM.
3. A 6-inch or 7-inch flow line carries the returns of air and dust cuttings about 200 feet from the rig. A valve the same size as the flow line is installed on the flow line approximately 60 feet from the rig. A 2-inch outlet should be installed down stream from the flow line valve in order to obtain formation samples. It might be advantageous to add a spool with a 7-inch flange outlet between the BOP and the rotating head and have two flow lines 180 degrees apart so that when the wind changes the dust cuttings can be switched from one flow line to the other to keep the dust from blowing on and over the rig.
4. The remainder is conventional rotary equipment.
5. The above can be rigged up for approximately $4200, including the

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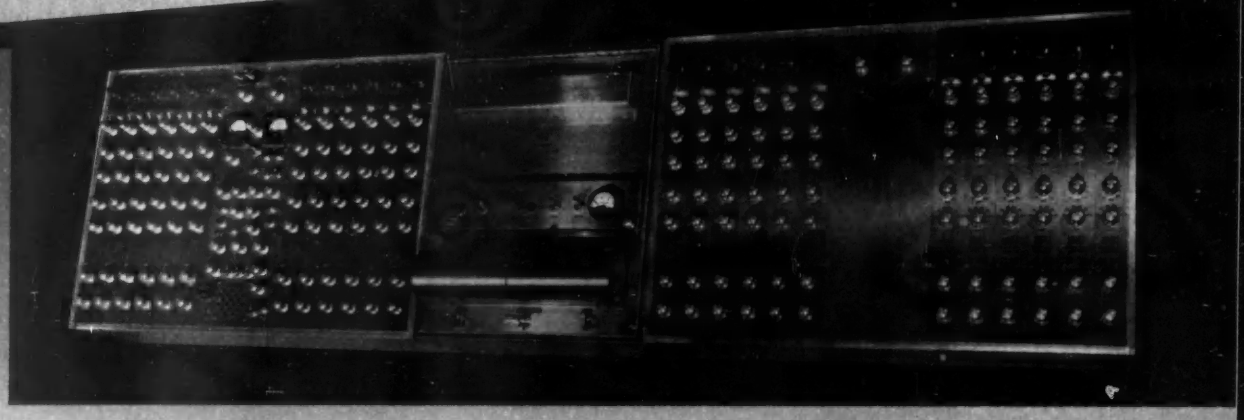
G-22 *Universal* SEISMOGRAPH SYSTEM

for "Critical Area" Recording



Recommendations and performance standards from the industry's foremost geophysical laboratories charted the development of the G-22 Universal SEISMOGRAPH SYSTEM. To meet these requirements SIE engineers have originated an entirely new "transistorized" AGC circuit which provides AGC control from ½ microvolt to ONE VOLT input level. New amplifier circuitry and special SIE transformers reduce harmonic distortion to less than 1%.

Special control circuits allow rapid field selection of AGC characteristics, mixing method and percentage, and type of record presentation. Hundreds of filter combinations are provided. Matching procedures are simpler than ever before . . . only moments are required to change recording characteristics.

The G-22 System is designed for high-production operation under all conditions from high noise level, multiple shothole areas to "shoot and move" recording. Regardless of the application, with magnetic or photographic recording media, the G-22 provides the ultimate in operating flexibility.

AGC Control Range: One-half microvolt to one volt input.

Low Distortion: Less than 1% from 10 to 300 cycles-per-second at 0.1 volt input.

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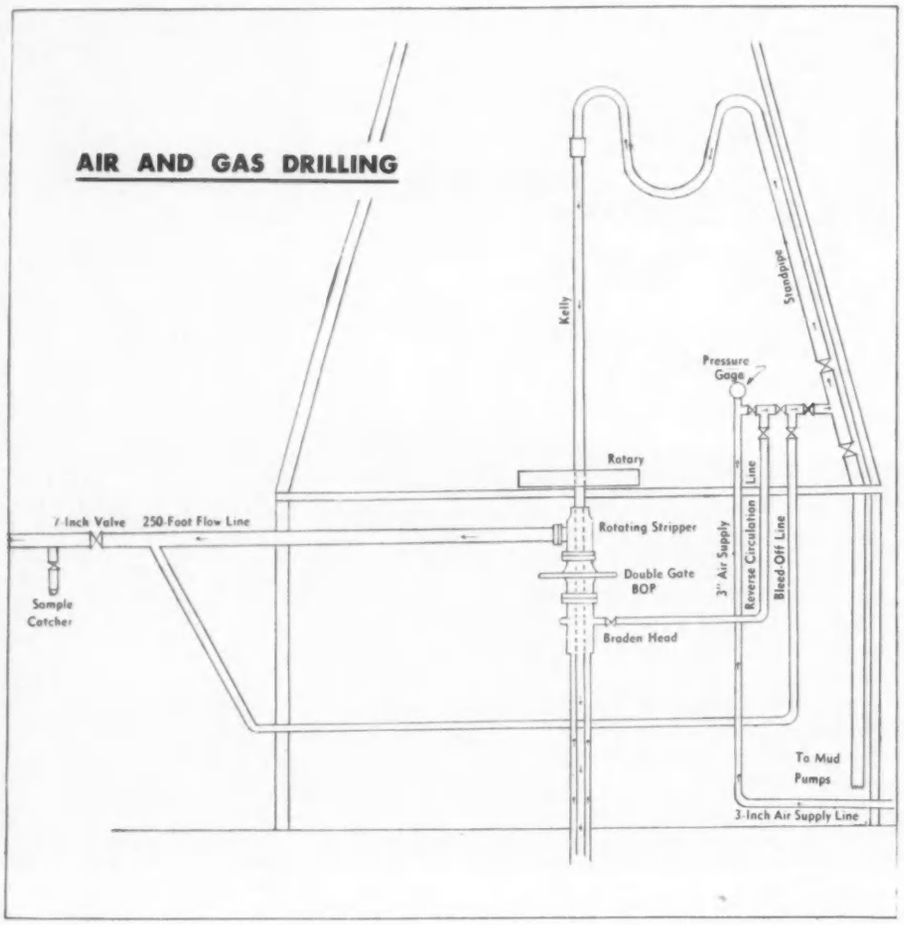

Fig. 1—Diagrammatic sketch shows the type of air drilling hookup recommended by the author. Notice the provision for quick reversal of circulation if it should be indicated.

rotating head. If it is preferred, the rotating head can be rented for approximately $625 per month.

6. Present West Texas prices indicate air compressors with a capacity of 1800 CFM including engines can be purchased for approximately $39,000, or can be rented for approximately $5000 per month. Air compressors with a capacity of 1800 CFM but without their own source of power can be bought for approximately $16,000 to $22,000, skidded, V-belted, etc. The author believes the most economical air would result from using rig power to operate the air compressors. The above applies to 125 pound per square inch units.

Advantages of air drilling as compared to conventional rotary drilling, using mud as the circulating medium are:

1. Increased drilling rate.
2. Greater bit life and footage.
3. Less possibility of injuring the pro-

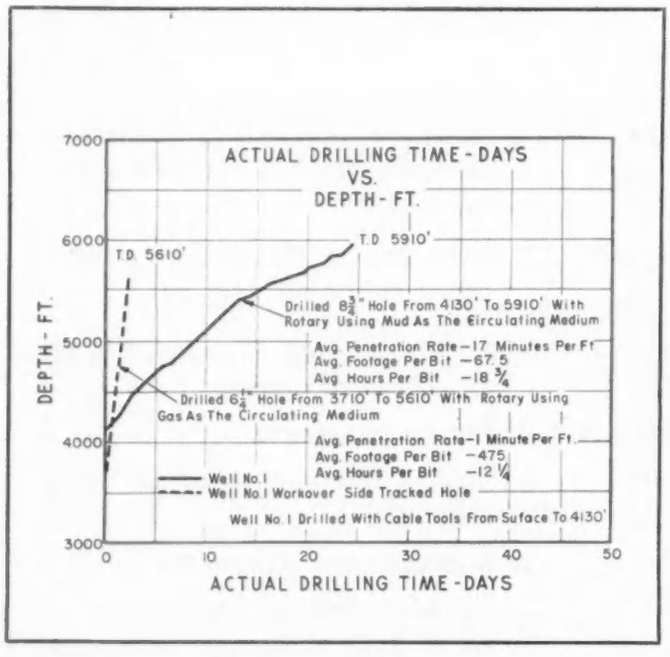
ACTUAL DRILLING TIME - DAYS VS. DEPTH - FT.
T.D. 5610'
T.D. 5910'
Drilled 8¾" Hole From 4130' To 5910' With Rotary Using Mud As The Circulating Medium
Avg. Penetration Rate – 17 Minutes Per Ft
Avg. Footage Per Bit – 67.5
Avg. Hours Per Bit – 18 ¾
Drilled 6¼" Hole From 3710' To 5610' With Rotary Using Gas As The Circulating Medium
Avg. Penetration Rate – 1 Minute Per Ft
Avg. Footage Per Bit – 475
Avg. Hours Per Bit – 12 ¼
Well No. 1
Well No. 1 Workover Side Tracked Hole
Well No. 1 Drilled With Cable Tools From Suface To 4130'
DEPTH - FT.
ACTUAL DRILLING TIME - DAYS

Fig. 2—West Texas Well 1 was initially drilled from 4030 feet to 5910 feet in 24 days drilling time. Penetration rates averaged 17 minutes per foot and 26 bits were required. 8¾-inch bits were used to 5553 feet and 7⅞-inch bits were used to total depth. Later the same well was sidetracked at 3709 feet and drilled to 5610 feet using gas as a drilling medium. Drilling time required almost two days. Average penetration rates were one minute per foot and only four 6¼-inch rock bits were required. In this instance gas drilling was 17 times faster than mud drilling.

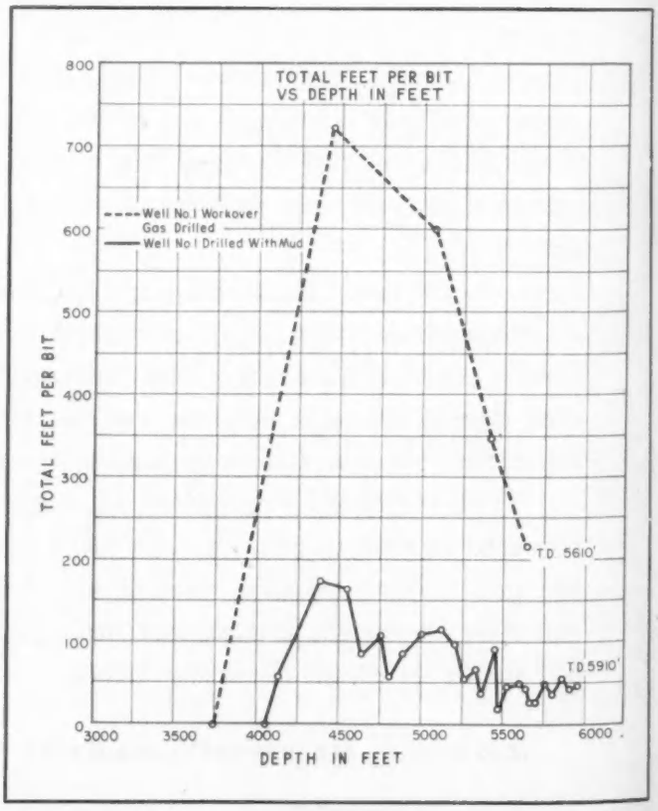

Fig. 3—This chart compares the footage per bit for mud drilling as compared to gas drilling in West Texas Well 1. Notice that the average footage per bit for the gas drilled hole was nearly eight times that for the mud drilled hole.

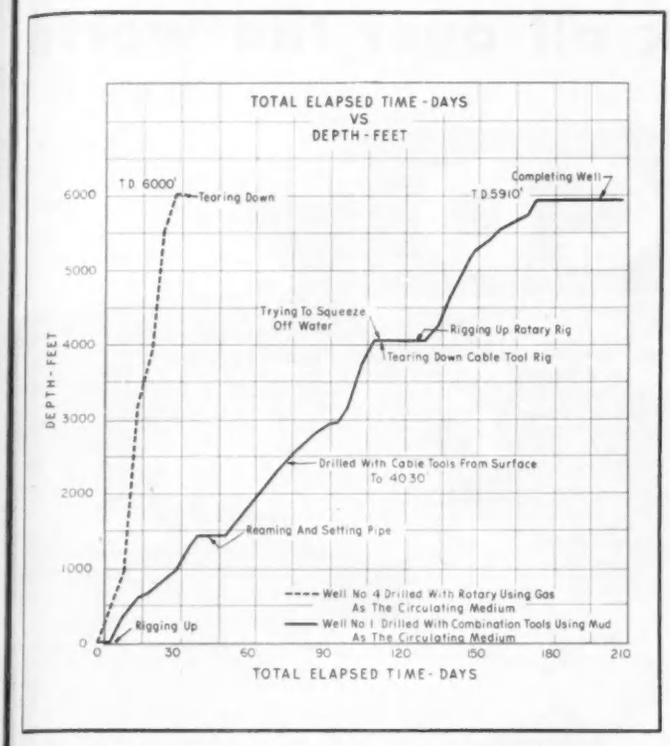
TOTAL ELAPSED TIME - DAYS
VS
DEPTH - FEET
T.D. 6000'
Tearing Down
Completing Well
T.D. 5910'
Trying To Squeeze Off Water
Rigging Up Rotary Rig
Tearing Down Cable Tool Rig
Drilled With Cable Tools From Surface To 4030'
Reaming And Setting Pipe
Rigging Up
Well No. 4 Drilled With Rotary Using Gas As The Circulating Medium
Well No. 1 Drilled With Combination Tools Using Mud As The Circulating Medium
DEPTH - FEET
TOTAL ELAPSED TIME - DAYS

Fig. 4—In this chart, the total elapsed time of drilling Well 1 (with cable tools and rotary with mud) is compared with the elapsed time for nearby Well 4, which was drilled entirely with gas. Notice that it took less time and fewer bits to drill Well 4 than it took to deepen Well 1 from 4090 feet to 5910 feet.

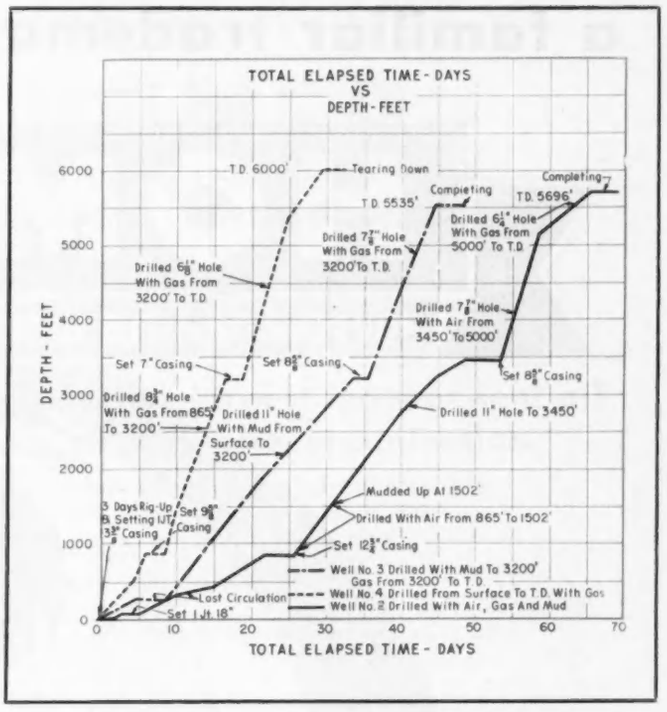
TOTAL ELAPSED TIME - DAYS
VS
DEPTH - FEET
T.D. 6000'
Tearing Down
T.D. 5535'
Completing
T.D. 5696'
Completing
Drilled 6¼" Hole With Gas From 5000' To T.D.
Drilled 7⅞" Hole With Gas From 3200' To T.D.
Drilled 6⅛" Hole With Gas From 3200' To T.D.
Drilled 7⅞" Hole With Air From 3450' To 5000'
Set 7" Casing
Set 8⅝" Casing
Set 8⅝" Casing
Drilled 8¾" Hole With Gas From 865' To 3200'
Drilled 11" Hole With Mud From Surface To 3200'
Drilled 11" Hole To 3450'
3 Days Rig-Up & Setting I.J.T. 3⅝" Casing
Set 9⅝" Casing
Mudded Up At 1502'
Drilled With Air From 865' To 1502'
Set 12¾" Casing
Well No. 3 Drilled With Mud To 3200' Gas From 3200' To T.D.
Lost Circulation
Well No. 4 Drilled From Surface To T.D. With Gas
Well No. 2 Drilled With Air, Gas And Mud
Set 1 Jt. 18"
DEPTH - FEET
TOTAL ELAPSED TIME - DAYS

Fig. 5—This chart shows a comparison of total elapsed time on Wells 2, 3 and 4. Well 2 alternately switched between mud and air to 5000 feet, where an inadequate gas supply was used to total depth. Gas was used to drill through a gas horizon, minimizing a possible explosive mixture. This well beat mud drilling even though drilling proceeded for a short interval then was shut down for several hours to allow pressure buildup. Well 3 experienced severe loss of circulation at 3200 feet while drilling with mud. After casing was set, a weak supply of gas was used to total depth. It is estimated 50 percent of the time was spent waiting on gas.

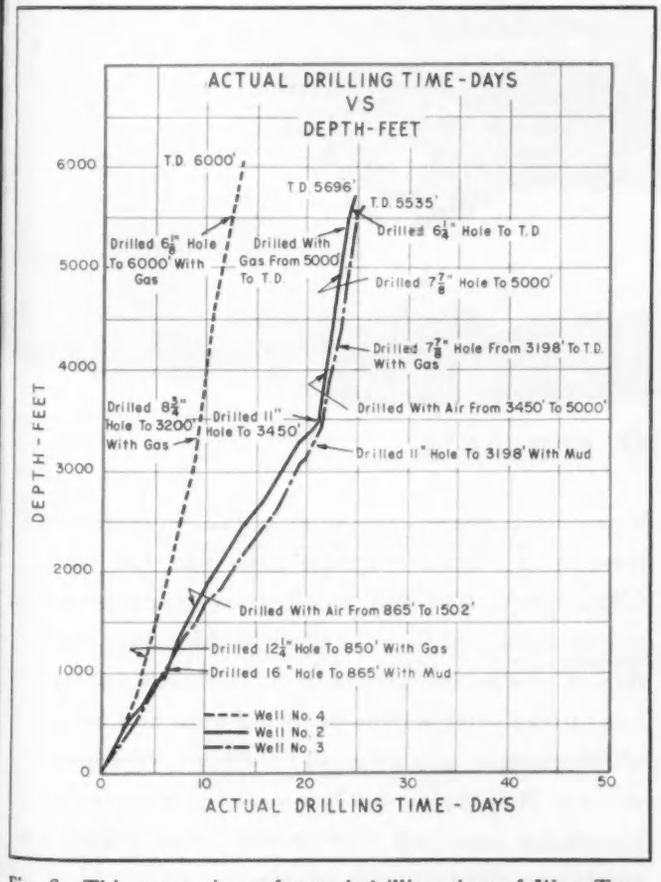
ACTUAL DRILLING TIME - DAYS
VS
DEPTH - FEET
T.D. 6000'
T.D. 5696'
T.D. 5535'
Drilled 6¼" Hole To T.D.
Drilled 6⅛" Hole To 6000' With Gas
Drilled With Gas From 5000' To T.D.
Drilled 7⅞" Hole To 5000'
Drilled 7⅞" Hole From 3198' To T.D. With Gas
Drilled 8¾" Hole To 3200' With Gas
Drilled 11" Hole To 3450'
Drilled With Air From 3450' To 5000'
Drilled 11" Hole To 3198' With Mud
Drilled With Air From 865' To 1502'
Drilled 12¼" Hole To 850' With Gas
Drilled 16 " Hole To 865' With Mud
Well No. 4
Well No. 2
Well No. 3
DEPTH - FEET
ACTUAL DRILLING TIME - DAYS

Fig. 6—This comparison of actual drilling time of West Texas wells 2, 3 and 4 shows the difference in penetration rates between that hole drilled with mud and that hole drilled with air or gas. Notice that the mud-drilled section of well 3 between 1000 feet and 3000 feet required 13 days while the same 2000 feet required only five days on gas-drilled Well 4.

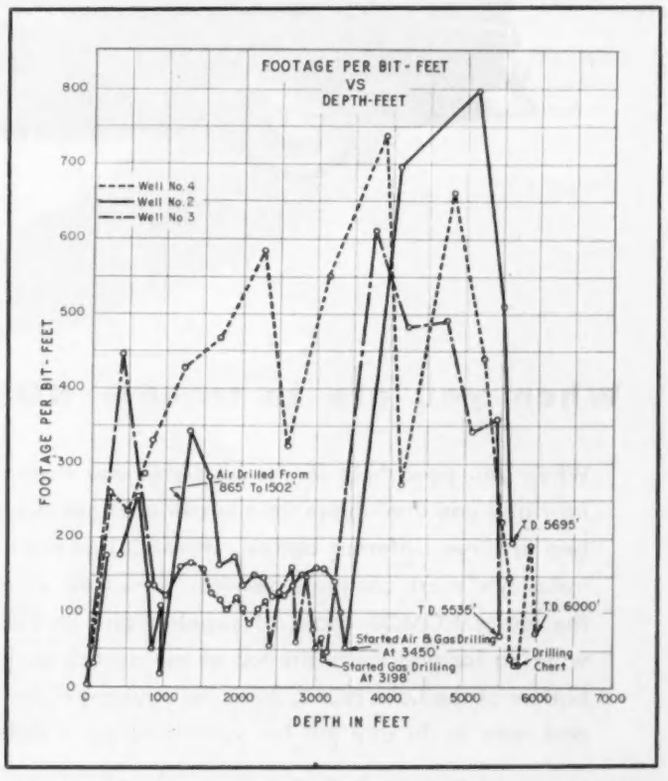

Fig. 7—This chart compares the footage per bit for mud drilling as compared to air and gas drilling in wells 2, 3 and 4. This points out the amazing characteristic of air and gas drilling—that conventional rock bits can be run dry and will give more footage service and will suffer less damage than when used in mud drilling. Teeth of bits have been worn smooth without ruining bearings. Milling up cones in 15 minutes is not uncommon with this technique.

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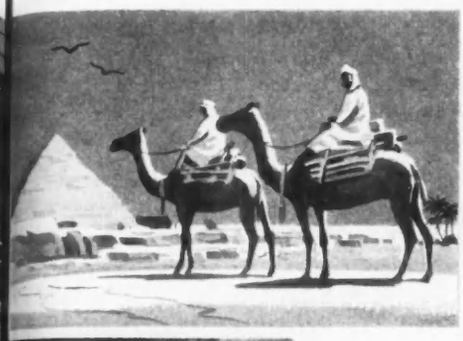

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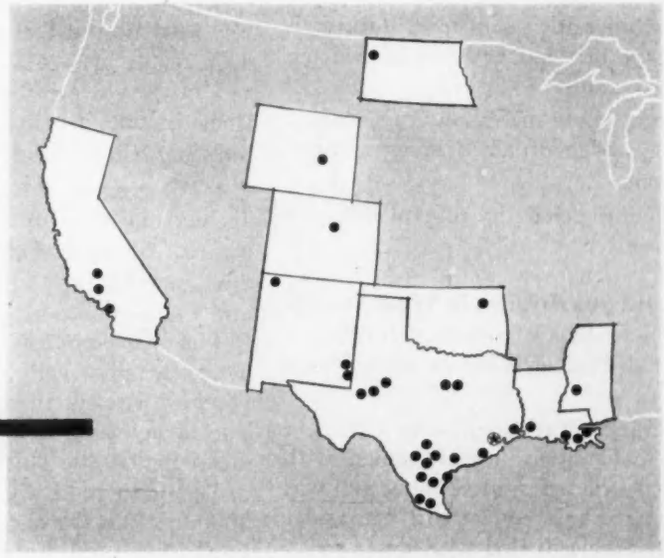

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New Mexico wells compared . . .

AN INTERESTING COMPARISON between air and mud drilling in Lea County, New Mexico, was drawn recently following the completion of offset wells.

On the air-drilled well, a green bit was pulled after drilling 780 feet in 28½ hours. The bit was run back in the hole and drilled 613 feet in 29 hours. Although the bit was still making one foot in seven minutes, it was pulled and found to be out of gage and the cones were absolutely smooth. Three zones were tested in three hours without special testing tools.

The air-drilled hole used 80 pounds per square inch absolute air pressures at 1500 cubic feet per minute. Weight on the bit varied from 10,000 pounds to 20,000 pounds at 60 revolutions per minute. Three hours were required to dry up the hole before testing. Depth was 4500 feet.

The mud-drilled offset well required 217 hours drilling time to drill the same interval while using 11 bits. Two drill stem tests were made in the same interval mentioned above in 16 hours.

ducing zone by drilling fluid.

4. Less loss circulation problems.
5. Less possibility of passing up a productive zone.
6. Excellent core recovery.
7. Drilling with less weight on bits. *(Editor's note: Some feel heavy weights will be future trend.)*
8. Less cement because of better gauged holes.

Disadvantages are:

1. Less control of large volume—high well pressures.
2. Inability at present to drill through water or cope with water bearing formations.
3. Compressor manufacturer's limited knowledge of air drilling requirements.
4. Remote possibility of explosive gas-air mixture.

Air and gas drilling in West Texas. Now let's look at some performances of air drilled wells in one West Texas area.

• **One well** was drilled to 4030 feet with cable tools and deepened with a rotary rig using mud. This well was later worked over and the sidetracked hole drilled with gas.

• **Second well** was spudded with gas but the volume of supply could not be maintained, so mud was used to 860 feet with much lost circulation trouble. Casing was set and air was used down to 1502 feet, where water in the hole made air drilling impractical. Mud was again used down to 3450 feet where casing was set. Air was used again from 3448 to 5000 feet. Gas was used from 5000 to 5696 feet.

• **A third well** was drilled with a rotary rig using mud to 3198 feet and through a very bad lost circulation zone. Casing was set and gas drilling started. Hole was drilled to 5335 feet.

• **A fourth well** was drilled with gas through the water zone to 850 feet and casing was set. Gas drilling was then resumed to a total depth of 6000 feet.

Thus, we have the histories of four wells in one area to give some interesting comparisons:

• **The first well** was drilled about 70 percent by cable tools, the rest rotary with mud. Total time was 210 days and 26 rock bits. See Figure 2 and Figure 3.

The best comparison was obtained when the first well was reworked. A window was cut in the casing and a sidetracked hole was drilled with gas down beside the old hole which was drilled with mud. From 4090 feet to 5600 feet the average rate of penetration using mud was 17 minutes per foot as compared to one minute per foot using gas. Even making allowances for gas drilling a 6¼-inch hole instead of the regular 8¾-inch hole, this is a striking example of what gas or air drilling can do. See Figure 2 and Table 1.

• **The second well** was drilled with rotary, about 50 percent with mud and 50 percent with air and gas, used alternately. Total time was 70 days and 29 rock bits to 5696 feet. See Figures 5, 6 and 7.

• **The third well** averaged about 100 feet a day with mud and 230 feet per day with gas. With mud, a bit averaged 128 feet as compared to 390 feet per bit with gas. See Figures 5, 6 and 7.

• **The fourth well** was drilled almost 100 percent with gas and total time was 31 days and 19 bits to 6000 feet. See Figures 4, 5, 6 and 7.

Source of air. As a source for air, independent from the rig, 125 pounds per square inch absolute is sufficient for 95 percent of today's drilling. Therefore, portable, gyro-type, 600 cubic feet per minute air compressors or portable water cooled 125 psia 500 CFM compressors are believed to be adequate.

These compressors can be acquired with either gas or diesel engines. For the other 5 percent of the drilling operations, higher air pressure is needed. These pressures are needed when displacing water with air in casing and cementing operations. When cuttings fall back to bottom, then higher air pressures are sometimes needed to break circulation and prevent a fishing job.

Also, when very small volumes of water are encountered, higher volume with higher pressures and especially higher air temperatures to dry up the water in the hole, might enable one to continue air drilling where it would be impossible with only 125 psia air. Normally it has been the author's experience that it is only safe or practical to air drill 50 to 100 feet after encountering water-bearing zones. If air drilling is to be continued, it is necessary to case-off the water. *(See aerated fluid article next month for alternate method—The Editor.)*

A second stage low RPM air compressor might be used to take air at 100 psia from the portables and boost the pressure to 350-400 psia. Special drilling hose or steel rotary hose can be used to withstand higher temperatures.

There have been instances while air-drilling in areas where the humidity is high, where moisture in the

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compressed air would condense in the drill pipe to such an extent that cuttings would be dampened causing considerable trouble such as sticking, etc. A simple drip can be constructed and air routed through the drip before it goes to the standpipe to eliminate this problem.

Coping with water. Some work is now being done to ascertain the effect of adding chemicals to air after drilling into water-bearing zones. The chemicals used keep water from wetting the cuttings. This may hold the key to future air drilling. *(See next month's issue—The Editor.)*

Air drilling is especially applicable where the penetration rate is especially slow when using mud as the circulating medium. As an example, Table 1 lists drilling times for 10-foot intervals, for Well 1 drilling using mud as the circulating medium and the drilling time for the same well in a side-tracked hole using air as the circulating medium. Note that the increase by air is almost 17 times faster.

TABLE 1

Well No. 1—Comparison of Drilling Times

DEPTH	Mud Drilling Minutes/10 Ft.	Gas Drilling Minutes/10 Ft.	DEPTH	Mud Drilling Minutes/10 Ft.	Gas Drilling Minutes/10 Ft.
4090–4100	257	6	4790–4880	157	10
10	267	8	90	138	12
20	182	10	4890–4900	165	6
30	165	8	10	150	4
40	204	8	20	125	16
50	118	10	30	170	14
60	...	6	40	192	14
70	185	6	50	167	8
80	135	10	60	160	10
90	135	6	70	130	8
4190–4200	115	8	80	180	10
10	105	12	90	140	12
20	110	8	4990–5000	140	6
30	95	10	10	158	88
40	105	8	20	200	10
50	105	8	30	240	8
60	101	6	40	180	6
70	89	10	50	160	14
80	90	8	60	181	6
90	105	6	70	169	8
4290–4300	100	12	80	180	8
10	77	8	90	165	12
20	91	10	5090–5100	170	16
30	125	10	10	165	10
40	151	10	20	185	44
50	110	12	30	152	6
60	124	8	40	136	10
70	...	8	50	164	12
80	121	8	60	170	8
90	110	8	70	154	6
4390–4400	129	8	80	209	6
10	115	6	90	85	6
20	148	8	5190–5200	132	6
30	123	8	10	120	8
40	117	8	20	106	12
50	103	20	30	88	12
60	105	8	40	125	10
70	120	6	50	115	10
80	123	8	60	212	8
90	116	6	70	135	16
4490–4500	114	6	80	220	10
10	113	10	90	258	16
20	127	6	5290–5300	340	24
30	113	6	10	120	12
40	110	4	20	83	20
50	110	6	30	89	28
60	95	6	40	344	10
70	150	8	50	148	10
80	169	6	60	126	12
90	162	10	70	153	22
4590–4600	231	4	80	155	20
10	203	8	90	195	16
20	...	8	5390–5400	159	14
30	125	8	10	173	12
40	105	8	20	142	8
50	115	8	30	214	10
60	115	10	40	233	10
70	140	6	50	435	6
80	135	10	60	319	10
90	122	6	70	246	12
4690–4700	225	6	80	299	12
10	237	6	90	333	12
20	230	8	5490–5500	207	18
30	281	10	10	298	26
40	137	8	20	266	14
50	228	12	30	236	10
60	225	10	40	217	18
70	240	10	50	248	10
80	285	8	60	283	16
90	110	6	70	287	16
4790–4800	125	6	80	384	10
10	230	6	90	260	10
20	190	8	5590–5600	531	46
30	210	6	10	426	20
40	170	10	20	732	48
50	115	20	30	252	20
60	167	8	40	345	10
70	133	12			

Type bits. Bits used in air drilling are the same as used in conventional drilling. All types have been tried while air drilling including air-jet bits. The conventional bits seem to give best results. When a very hard abrasive formation is encountered, chert bits have been used to good advantage in air drilling. On numerous occasions when the hardest rock bits would make only 20-30 feet per bit, chert bits were run and footage per bit would increase from 160-400 feet per bit. On several occasions chert bits have been used to air drill hard sandy shales with exceptional results. Chert bits normally will drill faster than diamond bits.

Approximately half the weight commonly used when drilling with mud is necessary while air drilling. However, some feel heavier weights will achieve faster rates since bits are standing up well.

Fishing jobs are performed in the same manner as when drilling with mud.

Since most air drilling operations are on a day work basis, it is recommended that the drill pipe be inspected before commencing operations. Full inspections should be made every 90 days of actual drilling time, thereafter.

Rubber stabilizers and large drill collars have been used with success in crooked hole areas.

Reamers used. Diamond reamers have been used to advantage in areas where extremely hard and abrasive formations are encountered. The diamond reamers were used primarily to indicate when the bit became out of gage rather than to ream the hole. Reamer would take weight when bit got out of gage resulting in a decrease in drilling rate. Before the diamond reamers were used, considerable time was spent reaming out of gage hole because there is no indication as to when the bit is out of gage or worn since the rate of penetration does not seem to decrease as the bit wears out.

—The End

CAN EXPLOSIONS OCCUR UNDERGROUND? We'll have some expert opinions along with valuable case history information on what to expect when drilling with air in a gas horizon. Watch for it next month.

Shell Oil Company Photo.

CUTTINGS BROUGHT TO SURFACE during air drilling operations stack up beside the well. Air drilling was done by Shell Oil Company at its South Mountain (Ventura County) property in an effort to overcome lost circulation problems encountered by conventional mud circulation while drilling surface hole to depths between 500 and 1200 feet.

IN CALIFORNIA

Faster Penetration Rates, Completion Advantages Seen

• Double drill pipe strings developed as special application for air and gas drilling techniques.

• Nitrogen gas has been tried as a substitute for air or gas in conjunction with double drill strings.

By GILBERT M. WILSON, WORLD OIL Staff

THE MOST RECENT application of air drilling in California fields occurred about two years ago in the South Mountain and Oat Mountain fields of Ventura County, California. Both areas are characterized by severe lost circulation troubles in the first approximately 1200 feet of surface hole. At South Mountain, these surface formations consisted of highly fractured volcanic formations and shales, while at Oat Mountain, surface formations consisted of dense, nodular, fractured shales with some sands.

Limited water supply in both fields prohibited rotary drilling without returns and, due to the highly fractured nature of the formations, cable tool drilling was very expensive and considered impractical due not only to the excessive time required as a result of numerous fishing jobs, but because of inability to keep a straight hole in most instances.

Rates Increased. Air drilling was used by four different operators in the drilling of a total of some 14 surface holes. In general, the results were very favorable, with increases in drilling rates, using air, ranging from 40 up to as high as 237 percent, as compared with penetration rates in similar formations encountered in adjacent, conventionally-drilled rotary holes. Cleaner, straighter hole, absence of mud cake and low viscosity of the gaseous drilling medium, are credited with much of the substantially-increased drilling rates. Greatly increased bit life, ranging from 36 to 348 percent, also was reported, yielding an estimated overall average increase of 123 percent.

Credit for this improved bit footage is given to several factors, including the cooling effect of expanding air at the bit; cooling capacity of the large volumes and highly turbulent velocities of air; and the rapid removal of cuttings. Comparison of air drilling costs with realistic figures obtained in conventional drilling practices resulted in an estimated overall saving of around 38 percent.

Equipment used on one of the projects, that of Shell Oil Company's South Mountain island-drilling operations, included a battery of nine portable compressors having a combined capacity of 4180 cubic feet per minute. Pressure at the bit was approximately 100 pounds per square inch.

As in most other air and gas drilling projects reported thus far, presence of water in the formation can cause considerable trouble. Mixing of water with fine cuttings, resulting in a balling up of the bit and plugging of the drill pipe, are typical of the moisture problems. The South Mountain operations were no exception, although not all of the holes drilled in that project encountered water in sufficient volume to effect the drilling.

Fractures Troublesome. In conventional circulation, that is, down the drill pipe and up the annulus, trouble would be experienced when large

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cavities or fractures were encountered. When such a void was hit, returns sometimes would drop to only 30 percent of the rate just before. Cuttings that ordinarily would have been blown out of the hole with normal velocity, would fall back and be re-ground due to the suddenly reduced velocity created by the larger hole size at that point.

In one instance, it was estimated that a column of some 50 to 60 feet of cuttings accumulated around the drill pipe. Sometimes these cuttings could be removed by raising the pipe and setting down on top of them and either rotating and drilling through them, or setting down and blowing them out. Switching to reverse circulation in some instances solved the difficulty and enabled them to get by the trouble zone.

Some idea of the size and resultant storage capacity of some of the cavities encountered can be gained from the fact that frequently, on making a new connection, or for some reason shutting down the compressors, air would continue to blow from the hole for as long as 10 to 15 minutes.

Some of the seepages encountered did not cause balling or plugging trouble and it is believed that the hot air, if in sufficient volume, dried up the moisture before it could cause trouble.

Although increased bit life was obtained in most instances, some trouble was found in loss of gage. Even though circulation ports were cut out with a torch to as large a diameter as possible, up to approximately three inches, some bits would come out with a watermelon shape, even though the teeth still remained sharp.

Air circulation was successfully used in the setting and drilling off of a whipstock. A 15-foot whipstock, in this instance, was set at 280 feet in the 15-inch hole and, after drilling off with an 8½-inch bit, then opening hole to 15 inches, and drilling on down to below 1000 feet, the shelf at the whipstock point still was plainly visible when viewed with the aid of a reflection from a hand mirror.

In the opinion of one person close to the above-described drilling operations, one answer to some of the problems encountered in air drilling may be found in going to large size drill strings, up to perhaps 10¾-inch drill casing and accompanied by greatly increased volumes of air.

Another air drilling test was made by a California company in one of the old, partially-depleted heavy-oil producing sand field. Although the test was inconclusive, objective of the operation was to learn if productivity of the sand, if drilled with air, could be improved over that obtained when conventional drilling fluids were used.

Conventional mud was used in drilling hole and cementing protection casing down to the top of the oil sand. Compressor equipment then was brought in and rigged for air-drilling of the producing sand, A string of 4½-inch drill pipe was used, and air compressor equipment consisted of three 600 cubic feet per minute portable units. Circulation pressure was 120 pounds per square inch.

Some 40 feet of hole was made successfully using air circulation but trouble then developed. Circulation could not be maintained and the compressors would unload. Upon pulling the drill string it was found that viscous oil, combined with sand, and blown up into the pipe, formed a very effective plug. The plugging difficulty was not overcome and the well subsequently was finished using conventional drilling fluid.

Cleaner completions mean better wells

In the California area, one of the most rewarding avenues in which air and gas drilling can play an important part is that of drilling-in and completing a well. The harmful effect of drilling into a low pressure sand zone with conventional rotary mud, particularly water base mud, is well known, and this is particularly applicable to California formation conditions.

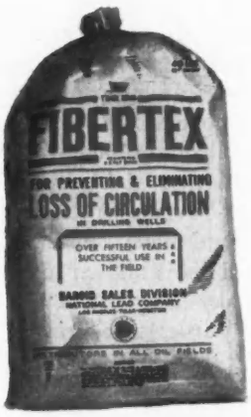
There are many advantages of a mechanical nature in air or gas drilling, such as reduced time in the zone; progressively obtained formation information while drilling; elimination of cleaning; and reduction of formation problems during the producing life of the well. Included in the production phase problems resulting from conventional completion operations are bailing, pumping, perforation cutting, swelling or heaving of shales and, of course, the actual blocking of the sand porosity of mud particles and the bentonitic shales which have expanded upon contact with water introduced by the drilling mud.

Drilling-in with air or gas permits coring and running electric logs and simplifies testing of sands as drilling progresses. From actual work that has been done in drilling into a zone with gas, the actual drilling can be accomplished faster and with fewer bits than with liquid drilling fluids. In this particular instance,[1] reference is made to two wells, drilled in 1938, into the Brown Zone in the Signal Hill field of California. Drilling with gas, the rate of penetration was held to ten feet per hour. Much of the hole appeared to be made without use of the bit. In one case 888 feet of hole was made in this manner and in the other case, 793 feet. Bit size was 7⅞-inch and, in each case, the holes could have been drilled with two bits. Circulation of gas was conventional (down through the three-inch drill pipe and up through the 8⅝-inch casing), and at volumes of up to 2500 Mcf per day with input pressures of from 450 to 500 pounds per square inch, with 30 psi on the sand trap located down stream from the casing outlet. Ten to 20 barrels per hour of clean oil from the same zone were injected as a spray to aid in carrying out cuttings and to lubricate the bit. Cuttings and oil were recovered in traps set up beside the well.

Formation tests easily made. Formation tests were run whenever desired merely by pulling up off bottom a few feet and circulating gas. After 2 or 3 hours, gas and oil volumes were produced by the well and were measured for a short time to complete the test. In the two actual completions mentioned, no hole calipers were run but the cuttings were measured and the volume in each case was 150 percent of the calculated bit size hole. Samples, coring and electric logs provided a complete log of the zone penetrated.

Substantiating the belief that it is

[1] *Gas-Drilled Wells Yield More Oil*, by Norman C. Wells, consultant, Long Beach, California. World Oil, November, 1952.



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reasonable to believe that drilling-in a well with gas will virtually eliminate all of the objectionable features or weaknesses of liquid drilling fluids, comparative decline curves have been made available (see Norman C. Wells' article previously referred to) on the first well drilled-in with gas in the Brown Zone on Signal Hill. The decline curve of this well, completed in 1938, was compared to each of the conventionally drilled offset wells. Cumulative production of the well drilled in with gas as compared with conventionally completed wells was 184% of the average of the adjacent five wells.

Hole stable long period after drilling. The second well drilled in with gas was not included in the decline curve comparison because there were no comparative offset wells. It is interesting to note however, that 10½ months after the well was put on production, the liner in the gas completed well unintentionally was pulled out of almost 800 feet of open hole when attempting to pull stuck tubing. This is striking testimony as to the stability of the hole after drilling in with gas. Unfortunately, the story can not be concluded by stating that the liner was as easily run back to bottom. It was necesssary to clean the well out with mud in order to reinstall the liner. Pulling the liner with such ease, however, is significant in itself.

The two gas-completed wells were drilled in at a cost equal to that of mud drilling and cleaning. Compressor equipment, traps, etc., were separately built and broken down, and the steam driven compressors were rented at considerable rental and repair cost. Boilers were rigged and fired with gas. Costs were abnormally high as compared to operating modern unitized equipment with portable multi-cylinder gas engines. The operations were carried out without incident, however, and took only about eight days over-all time for each well. This time could have been materially reduced with better equipment and with personnel experienced in both gas and drilling operations.

Gas drilling eliminates cake blocking. Conventional water-base mud drilling fluids have in common several possible deleterious effects in varying degrees on oil sands. These are: (1) Cake blocking; (2) Hydration of certain types of clays native to the sands; and (3) Particle penetration blocking.

Drilling with gas largely eliminates these objectionable occurences. In the case of cake blocking there has been some thought, supported by laboratory work, along the line that mud cake is largely harmless excepting in a secondary manner. According to one authority, it must be understood that this mud cake has been thoroughly worked into the sand face by the troweling action of drill collars and tool joints. In addition, the spurt mud at the bit instantly penetrates the sand, causing the third effect mentioned above, plus high fluid loss. This occurs repeatedly in a very short time until the action of the cutters of the bit has completely passed by. These actions occur to a highly damaging degree even with the best particle size distribution in the mud.

A belief exists in some quarters that subsequent cleaning of the sand face will permit producing the well to its full capacity and that as much ultimate production will be obtained as would be the case if the mud cake did not exist at any point. The falseness in this theory lies in one factor that is not considered. Coning of the flow through the sands to a concentrated point of entry into the well will result in an abnormally high velocity at this point, tending to cause disruption and consequent flow of sand. Due to the fact that most sands have less to no vertical permeability to oil as compared with horizontal permeability or, better stated, permeability parallel to the bedding planes coning toward a point of exit at the sand face will wastefully increase the gas-to-oil ratio as compared to flow towards an exit from all of the sand face in the hole. This probably would be true of most oil producing structures.

The second harmful effect of drilling mud, that of hydration of clays, is well known. Any water filtrate of a salinity different from that of the connate water in the sand will be harmful in this respect where that type of clay is present. Almost any water filtrate can be harmful at some time during the life of the well.

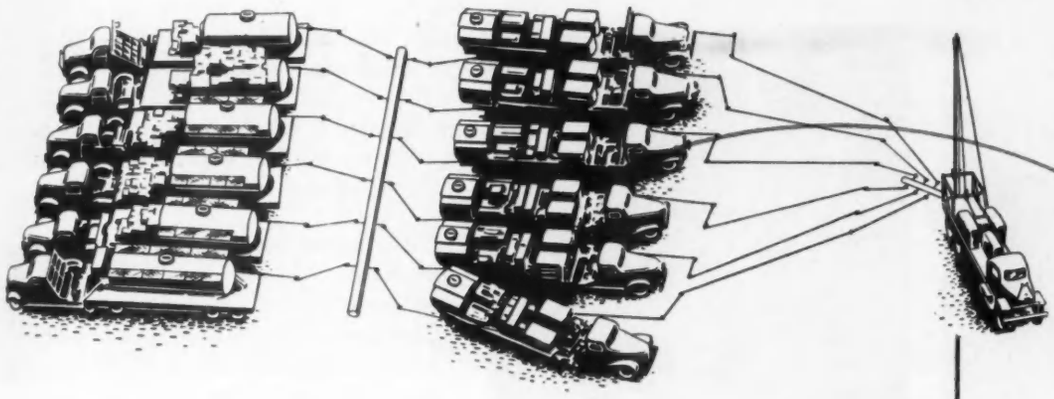
Particle penetration blocking, the third injurious effect on a producing sand, represents a continually prolific field for research. Considerable work has been done on this problem already but not all of the best of it has been completed and published. It would seem that particles in the native sand zones would have opposite electrical charges. This is known to be the case in the flaky lattice structure of clays. Foreign particles entering the sands probably soon become a permanent part of this structure and acquire their electrical charges in accordance with a rearranged system that reaches an equilibrium very quickly. It can be summarized that these particles either become immobile and form a permanent obstruction to flow of oil or move rapidly with such a high initial velocity of flow toward the well bore as to cause a packing in the interstices of the sand.

Any one, or a summation, of these effects reduces permeability of the sands, increases the gas to oil ratio by localized increased flow velocity, and decreases the recovery from the reservoir.

Gas drilling leaves sand in virgin state. All of these deleterious effects, of course, are largely overcome through the use of gas during the drilling-in of a well. Within limits of safety and controlling pressure, drilling in a well with gas has been proven to be a mechanically and economically feasible operation and should leave the sand face and all sand back of the sand face in very nearly its virgin state. An equilibrium condition of the sand relative to the sloughing, caving etc. would be reached during drilling at nearly the condition under which the well will be producing.

By this is meant that sand will be blown out of the hole at reduced pressure and that the comparatively small further reduction of pressure occasioned when the well is produced will cause little, if any, further movement of sand and shale. The damaging effects of cake and water and chemicals in the filtrates of all liquid drilling fluids are eliminated. In addition reduction of permeability by particle penetration of clays, blown asphalt, etc. are eliminated.

Continued



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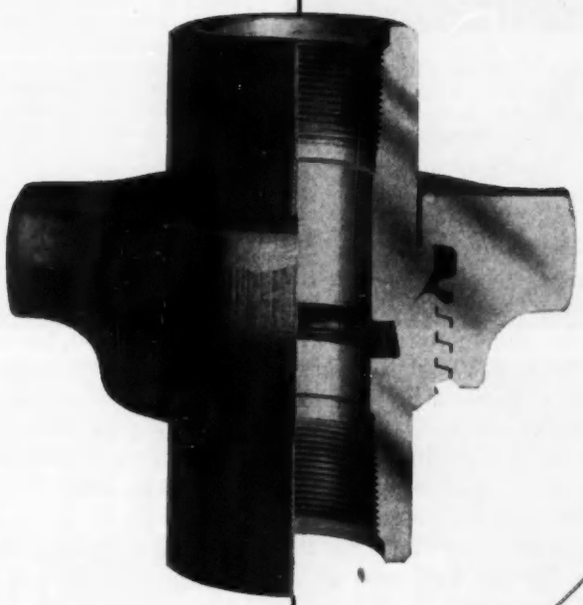

There's no place for weaklings in cementing, acidizing, formation fracturing and similar service operations. That's why WECO Unions are used by companies performing these oil well services. They need a union that makes-up and breaks-out fast—that seals securely time after time—that will withstand long, hard service. WECO Unions are giving service companies this kind of service. The protected* ball and cone seat seals and holds high pressures, corrosive and abrasive fluids on job after job. Their extra strong subs and nuts, precision machined and finished, meet the rigid requirements of service companies. Wherever you need a Union, you need a WECO Union and there's a size and pressure for every service.

* Resilient seal ring in

Fig. 402,	4,000 psi.	Fig. 1002,	10,000 psi.
Fig. 602,	6,000 psi.	Fig. 1502,	15,000 psi.

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A SMALL RIG drilling with air, using small diameter double drill pipe string. Note small packed-off drilling head which prevents escape of dust-laden air beneath rig.

MAKING NEW CONNECTION with double string of drill pipe. Air is circulated down annulus between two-inch outside diameter outer string and up 1¼-inch O.D. inner tube. Inner tube has slip-type joint sealed with O-ring. Outer tube has conventional square threads.

Double drill pipe string developed. A new, patented, technique developed over the past several years and presently undergoing field tests with a small-size string of drill pipe, is the use of a double string of pipe. This is a double concentric drill string which reduces the required circulation rate, as circulation of gas or air is down the annulus, between the inner and outer tubes, and up the inner tube. Spider type spacers at regular intervals maintain a constant annulus between the two strings. The outer string is equipped with conventional square threads while the inner tube has a slip joint sealed with an O-ring seal. The joints are made up in conventional manner and are handled as rapidly as with conventional drill pipe joints.

The test string presently in operation consists of a 2-inch outside diameter x 1½-inch inside diameter outer tube and a 1¼-inch O.D. x 1-inch I.D. inner tube. It is made up in 10-foot lengths. It is comtemplated by the developer of the design that this size string shortly will be used in exploration and core hole work, a field wherein air or gas drilling has numerous advantages including the ability in most cases to make hole faster; and ability to recover uncontaminated cuttings, the latter returned to the surface in much shorter time.

One of the inherent and more important advantages contained in the double string drill pipe is the fact that complete control over circulating volumes is available to the operator at all times. This means that a constant, predictable velocity can be maintained and, because the gas does not flow between open hole and the drill string, there are no hole enlargements and no tendency for saving or sloughing of otherwise soft or unstable formations.

With air or gas drilling, of course, unstable formations will be at a minimum due to the absence of moisture that drilling mud or other liquid circulating fluid would impart to formation clay particles. A full-size string of drill pipe, made up as a double string on the order of the small-size string described above, shortly is to be made up for the express purpose of drilling-in and completing wells.

Nitrogen gas as circulating medium. Also being developed by the same firm is a technique wherein nitrogen gas is to be used, as a substitute for either air or gas, in conjunction with the double string drill pipe. Cost of nitrogen would be quite low as compared with liquid circulating mediums. Some representative costs and other data comparing the nitrogen, double drill pipe string technique with operating conditions existing at the time the Signal Hill Brown Zone completions were made in 1938, are given in Table 1.

Nitrogen gas, available in large bottles or tanks, easily can be brought to the rig and filled at regular intervals by the supplier as needed. In addition to being a circulation medium in areas where gas is not available in sufficiently large volumes, or where air might contribute to a fire hazard, nitrogen gas is inert and thus is, in itself, a down-the-hole blowout preventer. In addition, as an added precaution, it would be possible to install remote-controlled, emergency nitrogen jets in the cellar and other strategic locations for use if extinguishers should be inadequate.

TABLE 1
Closed System Gas Drilling
Natural Gas vs. Nitrogen

	1938 Gas-Drilled Completion at Signal Hill	1954 Proposed Nitrogen Gas Closed System
Water String	8⅝" at 3842' in Brown Zone shale. Drilled, cased and tested w/conventional mud.	Ditto
Bit Used in Zone	7⅞" rock bit	Special bit
Drill Pipe	3½"	2½" in 4" tbg. (Double String)
Size Liner	6⅝"	Ditto
Hole Drilled w/gas	888'	Ditto
Bits Used	3	1
Days Drilling Zone	8	6
Compressors	5—10x4½x12 steam	2—40 H.P. gas engines
Boilers	5	None
Total Fuel (ex. rot. rig)	6,129 MCF	90 MCF
Gas Circulated	Natural Gas	Nitrogen
Maximum circulation Rate	2,250 MCFD	500 MCFD
Discharge Pressure, psi	250—450	300—500
Intake Pressure, psi	50	50
Formation Pressure, psi. ga.	85	85
Oil Spray Cu. Ft./Barrel	4700	4700. or no oil
Gas to Charge System	40 MCF	40 MCF
Total Gas Used	515 MCF	300 MCF
Nitrogen at 50¢/100 Cu. Ft.	.....	$1250 "Mud bill."*
Physical Properties:	**Methane CH_4**	**Nitrogen N_2**
Molecular Weight	16.04	28.016
Specific Gravity (air=1.00)	0.554	0.972
Density, Lbs./Cu. Ft.	0.0424	0.0744
Volume, Cu. Ft./Lb.	23.57	13.44
Volume, Cu. Ft./Gallon	59.1	93

* Assuming 100 percent make-up every 24 hours.

Remark extracted from original report on 1938 job:—"The first test did show a fairly high rate of gas (production) which is rather difficult to explain. Probably this zone was very loose sand that was later packed with cuttings."

—The End

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Part 3

A Series on Modern Drilling Technology—The Importance of Rock Bit Size.

WORLD OIL is proud to present this outstanding article that promises to give the answers to slim hole drilling as far as rock bits are concerned. Here, published for the first time, the authors give valuable information about rock bits and performances to be expected. They relate casing, hole size and rig equipment to total well cost—THE EDITOR

By ROY A. BOBO, Director, **ROBERT S. HOCH,** Engineer, and **GEORGE S. ORMSBY,** Engineer,
Drilling Engineering Division, Phillips Petroleum Company, Houston

ONE OF THE MOST critical decisions that must be made prior to drilling a well is the selection of casing and bit programs. This has an important bearing upon drilling economics because it dictates the size of rig the contractor will use and also influences the number of days that will be required to drill the well.

Selection of the surface and intermediate hole and casing sizes should be based on a compromise among those economic factors, sofar as they can be determined, which will result in the least hole cost when total depth is reached and also satisfy completion requirements.

Most contractors are aware that popular, larger size holes (7⅞ inch through 9⅞ inch) can generally be drilled in a shorter time with fewer rock bits than a smaller diameter hole. With any given rig, a reduced number of days on a well will result in a lower total well cost. A smaller hole, though requiring more bits and more drilling days, may result in less total well cost by permitting the use of a lighter weight, more portable and lower operating cost rig. From the standpoint of drilling only, the ideal situation is to drill the **largest hole** with a rig having the **least operating cost** and equipment necessary for maximum bit performance.

Bit load, rotary speed and hydraulic conditions all are variables which greatly influence time spent in drilling a well. It should be understood that changes in bit size must be accompanied by the most effective utilization of these other factors in order to obtain greatest benefits.

A typical comparison of bit performances of large versus small diameter was made on a recent well drilled in the Gulf Coast area. This well was initially drilled with an 8¾ inch bit. The 5½ inch oil string was stuck as it was being run in the hole. A whipstock was set and 4¾ inch hole was drilled beside the 8¾ inch hole. The 4¾ inch rock bits drilled a 1161 foot section of formation using 25 bits in 260 rotating hours, whereas this same section of formation required only 10 bits and 160 rotating hours using 8¾ inch rock bits. At least as great a difference in performance could be expected if these two bit sizes were tested in a hard formation area. **This article is intended to give a better understanding of the relationship of bit size to bit performance.**

The discussion will cover these subjects:

Effect of bit size on bit footage.
- **Bearing life**
- **Tooth life.**

Effect of bit size on penetration rate.
Rock bit types available for various sizes.
Popular rock bit sizes.
- **Soft formation areas.**
- **Hard formation areas.**

Special problems due to hole size.
- **Small holes.**
- **Large holes.**

Relating hole size and rig equipment to total well cost.

Footage life. Because of many influencing factors, the relationship that exists between bit size and potential footage of the bit is not as readily understood as the relationship between bit size and penetration rate. The life of a rock bit is terminated by failure either of teeth or bearings or both.

Factors which affect footage life and which change with bit size are: available roller bearing area per inch of bit diameter, available cubic inches of tooth steel per square inch of bottom hole surface, and metallurgy. The following discussion will present the relationship between these factors and bit bearing and tooth life.

Bearing life. Rock bit bearing life is governed by the bearing area that is provided for each inch of bit diameter. Figure 9 is presented as a means of relating bit bearing life to bit size by showing the bearing area per inch of bit diameter that is available in various size three-cone bits. Since this factor (Figure 9) decreases rapidly

as bit sizes are reduced, it follows that bearing life will decrease in much the same proportion. As an example, Figure 9 shows that an 8¾ inch bit has twice the bearing area per unit diameter as a 5½ inch bit of the same type. For this reason, the larger bit will have only one half the bearing stress as the smaller bit when each is loaded to achieve identical penetration rates (equal weights per inch of bit diameter) in a given formation. Hence 8¾ inch bit bearings should last at least twice as long under equivalent conditions.

An interesting observation from Figure No. 9 is that the bearing area available in 8¾ inch hard formation type bits is about 12 per cent greater than in 8¾ inch medium formation type bits. Thus if bit failure is caused prematurely by bearings, a harder type formation bit having a larger bearing may be advisable.

One manufacturer uses roller type bearings in bits larger than 5 inch diameter. Bits smaller than 5 inch have journal type bearings. Where space permits their use, roller bearings in rock bits will generally have a longer life than journal bearings. Smaller bits having journal type bearings should be operated at slow rotary speeds.

Where consistent premature bearing failures occur that cannot be attributed to bit type selection, mud characteristics, or loading conditions, the economics of changing casing programs to accommodate a bit size having larger bearings should be investigated.

Tooth life. When the life of the rock bit is terminated by tooth wear, one factor which relates total bit footage to bit size is the available cubic inches of tooth steel per square inch of hole surface. Experience has shown the amount of steel which is worn off the cutters to be a function of the volume of rock that has been removed. Figure 10 shows roughly the amount of usable tooth steel in various size hard formation tri-cone bits of one make. The heavy solid line shows that the volume of usable tooth steel per square inch of hole tends to decrease directly with bit size. Consequently, at the same loading per inch of bit diameter, the potential tooth footage of a bit will decrease in about the same proportion. Based only on available tooth steel per square inch of hole area, Figure 10 illustrates that **twice as much footage may be anticipated with an 8¾ inch bit as with a 4¾ inch bit.**

When extremely hard formations are being drilled with maximum permissible bit weights, the potential tooth footage may trend more nearly with the dashed line of Figure 10. This is because the low bearing area per unit diameter in very small bits will not withstand loads sufficient for efficient tooth action in these hard formations. Larger bits, with their much higher bearing capacities, can withstand loads which result in greater tooth efficiency, or more formation removal per unit of tooth wear.

Constant improvement in drilling practice leads to changes in bit design. The dotted line in Figure 10 graphs the actual volume of the tooth steel in various design sizes for one specific type and make of bit as of a recent date. **It is obvious that a few of these sizes deviate**

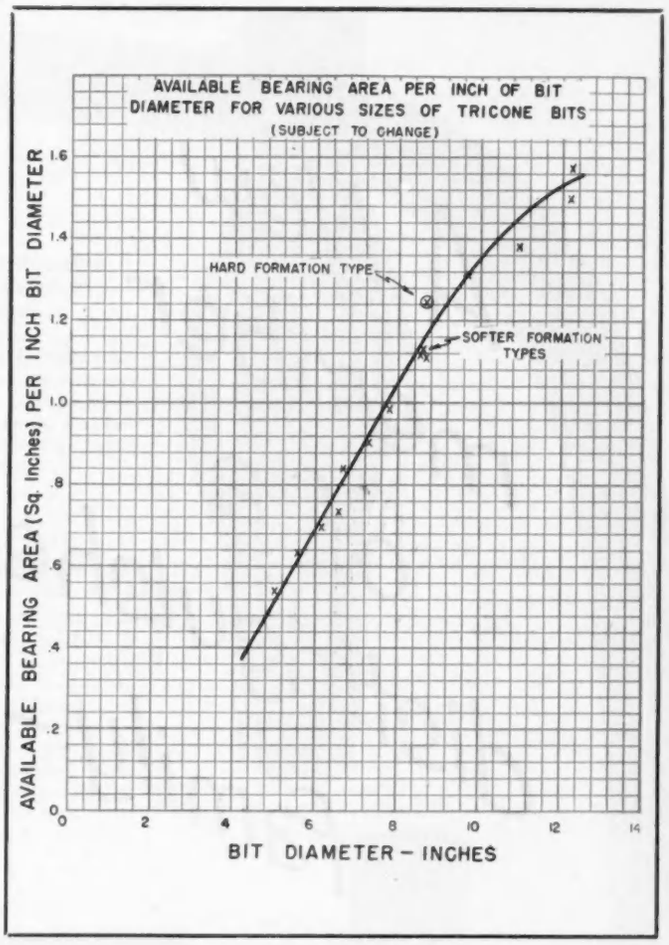
AVAILABLE BEARING AREA PER INCH OF BIT DIAMETER FOR VARIOUS SIZES OF TRICONE BITS
(SUBJECT TO CHANGE)
AVAILABLE BEARING AREA (Sq. Inches) PER INCH BIT DIAMETER
HARD FORMATION TYPE
SOFTER FORMATION TYPES
BIT DIAMETER – INCHES

FIGURE 9

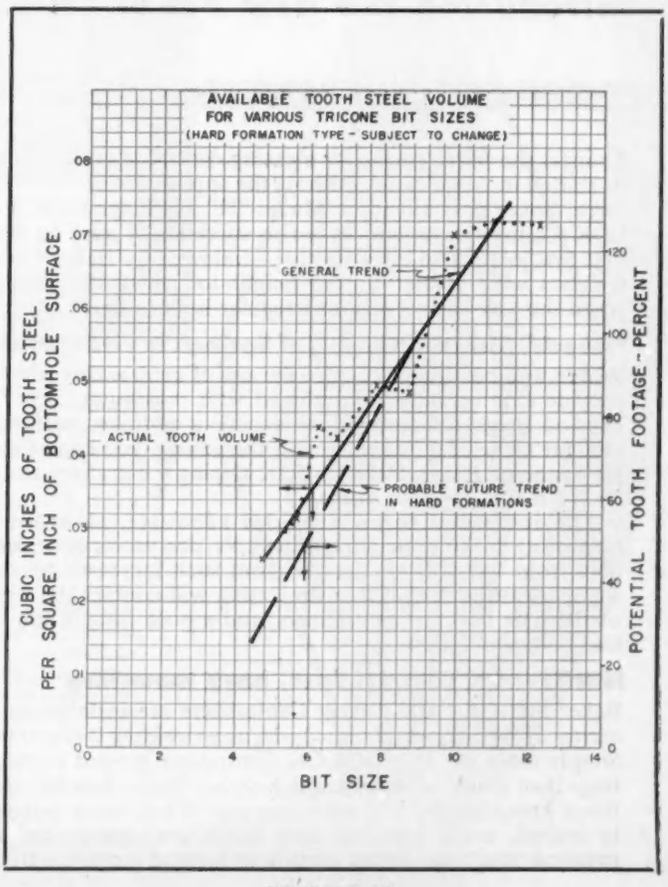
AVAILABLE TOOTH STEEL VOLUME FOR VARIOUS TRICONE BIT SIZES
(HARD FORMATION TYPE - SUBJECT TO CHANGE)
CUBIC INCHES OF TOOTH STEEL PER SQUARE INCH OF BOTTOMHOLE SURFACE
POTENTIAL TOOTH FOOTAGE - PERCENT
GENERAL TREND
ACTUAL TOOTH VOLUME
PROBABLE FUTURE TREND IN HARD FORMATIONS
BIT SIZE

FIGURE 10

A New member of a distinguished family—

BAKER MODEL "H" 15-Range HINGE-LOK Casing Centralizer Product No. 9115
For easy starting in "slim" holes.

Introducing the new Baker "H-15" HINGE-LOK Casing Centralizer...

To meet the requirement for a casing centralizer which can be started in "slim" holes, without the application of external force, Baker now offers the Model "H" *15-Range* HINGE-LOK Casing Centralizer. It is also successfully used on the first few joints—for easy starting—followed by Baker Centralizers with greater bowed height to center the casing when the hole is over-size or irregular in bore size.

"Reach" (Bowed Height) of Springs is vital factor

Where well conditions require the use of centralizers which provide *ease of starting* combined with *maximum "reach"* (bowed height of springs) to ensure a positive, uniform annular cementing space around the casing, you can select the range of Baker HINGE-LOK Casing Centralizer truly "tailor-made" for your needs.

The increased reach provides adequate, all-around cementing space even though the hole size varies considerably from the drill bit size. Without such increased reach, there always is danger that the casing will contact the wall of the hole between centralizers, and a poor cement job at that point will follow.

HINGE-LOK permits fast, easy mounting

Baker HINGE-LOK Casing Centralizers are *installed in a matter of seconds* while running-in, as *no welding is required.* Simply close the HINGE-LOK Centralizer around a coupling—then insert drive nails which *thread themselves* into the hinge knuckles and *will not come out.* When exact spacing is desired, easily installed Stop Rings are plug-welded at required positions. Either mounting method permits unlimited free rotation of the casing *without* rotation of the centralizers.

Easily Started WITHOUT "Snubbing"

By properly selecting and spacing centralizers of suitable range, all need for applying external starting force is eliminated, even in "slim" holes. The superior spring design of Baker HINGE-LOK Casing Centralizers permits easy starting, but the powerful centering force remains after reaching the desired cementing point.

Maximum effective centering force

Inasmuch as the primary function of any casing centralizer is to provide a *positive, uniform annular cementing space around the casing,* the "maximum effective centering force" is likewise of primary importance. Baker HINGE-LOK Casing Centralizers provide the *desired cementing space at the cementing point* regardless of repeated flattening of the springs. This advantage is especially desirable in off-vertical holes.

The engineered bow shape of the springs, with an ideal relationship between the length and the bowed height of the springs, provides *maximum landed centering force* in any combination of casing sizes and open hole sizes.

Call BAKER for "Resultful" Centralizer Service

Just call any Baker representative or office for the kind of service every operator appreciates—sincere, courteous assistance to help you get successful "first-time" Cementing results.

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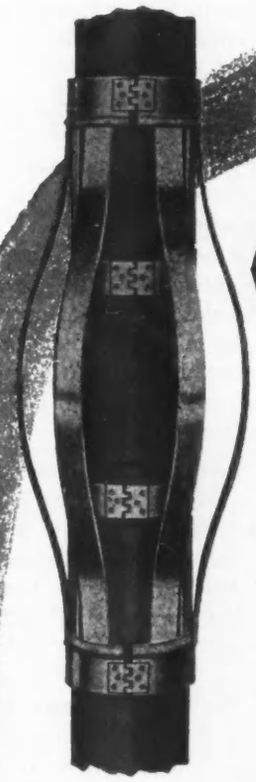
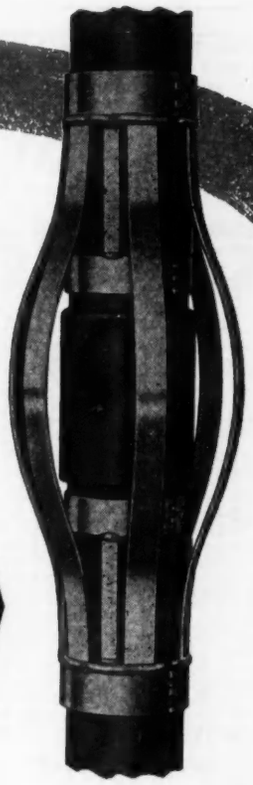


BAKER MODEL "H" 20-Range HINGE-LOK Casing Centralizer • Product No. 9112

Recommended where LESS-THAN-NORMAL CLEARANCE exists between the casing ON which the centralizers are mounted and the casing THROUGH which the centralizers are run. In cases of over-size or irregularity of the open hole, it is often advisable to run the "H-20" Centralizer on the first few joints—for ease in starting—followed by the "H-25" or the "H-50" Super-Range Centralizer.



BAKER MODEL "H" 25-Range HINGE-LOK Casing Centralizer • Product No. 9113

Recommended where NORMAL CLEARANCE is present, and no serious problem of over-size hole is anticipated. The "H-25" Centralizer is recommended where conditions are such that starting force would be a problem with the "H-50" Super-Range Centralizer, in which case the H-25 might be used on the first few joints and the H-50 run above it. Although the H-50 requires a larger spacing interval for easy starting than centralizers having a smaller range, fewer "H-50" Centralizers—with their superior reach—ensure even greater effective centering force.

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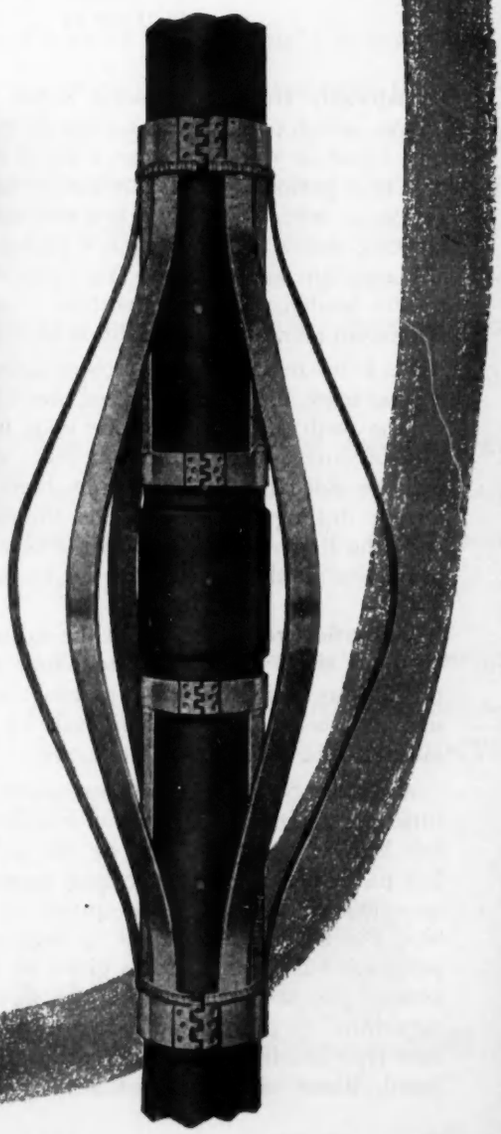

BAKER MODEL "H-50" Super-Range HINGE-LOK Casing Centralizer • Product No. 9114

Recommended for GREATER-THAN-NORMAL CLEARANCE—wherever the diametral clearance between the casing ON which the centralizers are mounted, and the casing THROUGH which they are to run exceeds five inches; or for NORMAL CLEARANCE where extensive hole irregularities are anticipated. No other centralizer can provide such effective centering action as the "H-50" in *irregular or over-size hole sections*, or in *cavities*. By increasing the bow of the springs (without proportionately increasing their resistance to starting) maximum centering efficiency is assured, regardless of individual well conditions.

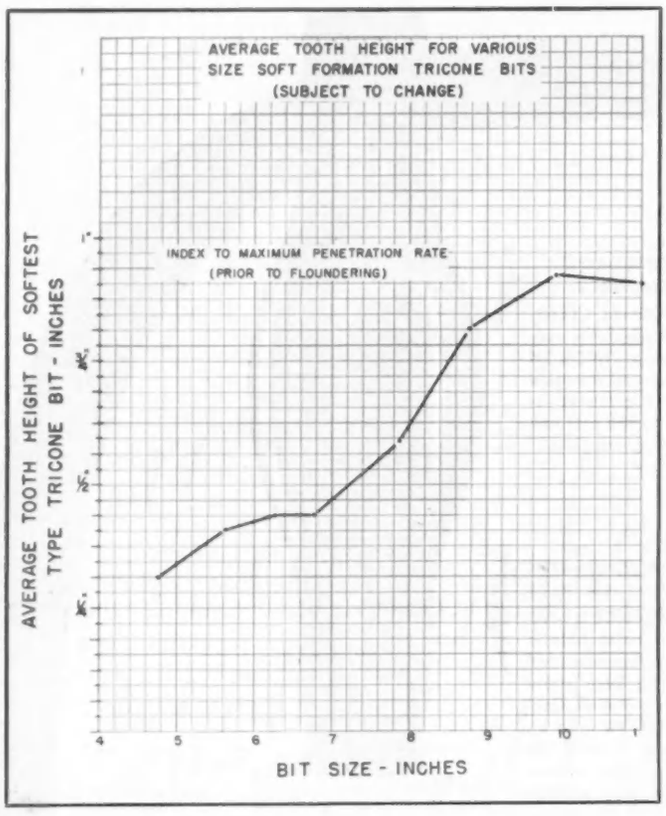

FIGURE 11

considerably from the general trend. This and similar curves, which could be drawn for all types and makes of bits, illustrate why sometimes a bit of one particular size and type performs noticeably better than a larger one of the same type, especially when maximum drilling effort is being made. Future design changes in all probability will result in less deviation from smooth trend lines due to the tendency of rig operators to maintain closer to maximum allowable bit weight on all size bits.

Rock bit metallurgy is another factor that can cause shorter tooth life in smaller sized bits. The carburized case on the teeth surfaces and cone body must be thinner as bits become smaller in order that cone shell strength will be adequate to withstand high stresses incurred during drilling operations. The thinner this carburized case, the less resistance teeth have to abrasion—resulting in reduced tooth, and also bearing, footage.

Penetration rate. In all but the softest formations, and with the same rpm and bottom hole cleaning action of the drilling fluid, the instantaneous penetration rates of smaller bits would approach those of larger bits, if the same loading per inch of bit diameter could be obtained.

As stated before, in hard formations drilling rate is a function of bit load per inch of bit diameter. The higher this loading the faster will be the drilling rate. Larger bits have higher permissible load ratings and can consequently maintain higher penetration rates than the smaller bits. Figure 9 can be used to estimate the maximum permissible bit loading for a given bit size. For example, assume that 8000 pounds per inch of bit diameter is the maximum operating load that an 8¾ inch hard formation type bearing system will withstand at a low rotary speed. Based on equivalent bearing loads for the 8¾ inch and 5¼ inch bits, roughly 4000 pounds per inch of bit diameter would be the theoretical permissible loading for a 5¼ inch bit at the same rpm. Consequently this smaller bit would drill half as fast.

In softer formations, larger size bits can also have higher penetration rates because they have more tooth height with which to gouge out larger chunks of formation. This results in deeper tooth penetration per bit revolution before bit floundering occurs. (The relationship between bit penetration rate and formation removed per bit revolution was presented in Part 2—Figure 8.) The maximum tooth height available in a given bit size can be used as an index to the maximum penetration rate that can be obtained. Figure 11 shows the maximum tooth height available in the various sizes of bits of a one particular rock bit manufacturer.

It must be thoroughly understood that greater potential effectiveness of larger bits can only be realized with rigs capable of handling sufficient drill collars. If mud pump horsepower is insufficient to allow proper cleaning of the hole below the large bits, then smaller bits are in order for that rig. Here again, a change may be advisable in the casing program to fit the available rig.

Rock bit types available for various sizes. The value of having a wide selection of bit types available for drilling a given well depends upon the variations in formation characteristics and ability of personnel to select proper bit types. Use of certain bit sizes for drilling the long hole should be avoided due to the limited types available in these sizes. Table 2 (below) lists the three-cone bit sizes commonly manufactured and stocked in a wide selection of hard, soft and intermediate types. Larger, smaller and intermediate sizes often include only two or three types with jet nozzles and chert bits usually not available. Also, few of these sizes are carried in stocking points. Table 2 is subject to change, but obviously it should be ascertained that the bit sizes and types needed of the make desired will be available before the final decision is made regarding the casing and hole size program.

Popular soft formation sizes. When drilling extremely soft formations, larger bits are often used because their greater tooth height allows more weight per inch of bit diameter to be applied before the floundering load is reached, providing deeper tooth penetration and faster drilling rates. Also, larger bits have greater bearing life, which in these circumstances is often more critical than tooth life. The most popular rock bit sizes in the soft

TABLE 2

Three-Cone Bit Sizes Stocked in Wide Selection of Formation Types
(One manufacturer and subject to change)

BIT DIAMETER	ALSO AVAILABLE	
	Jet	Chert
6¾	x	x
7⅞	x	x
8⅝	x	x
8¾	x	x
9	x	x
9⅝	x	
9⅞	x	x
10⅝	x	x
11	x	
12¼	x	

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When you buy your next string, specify **REED** Tool Joints. We can furnish any type pipe connection you desire.

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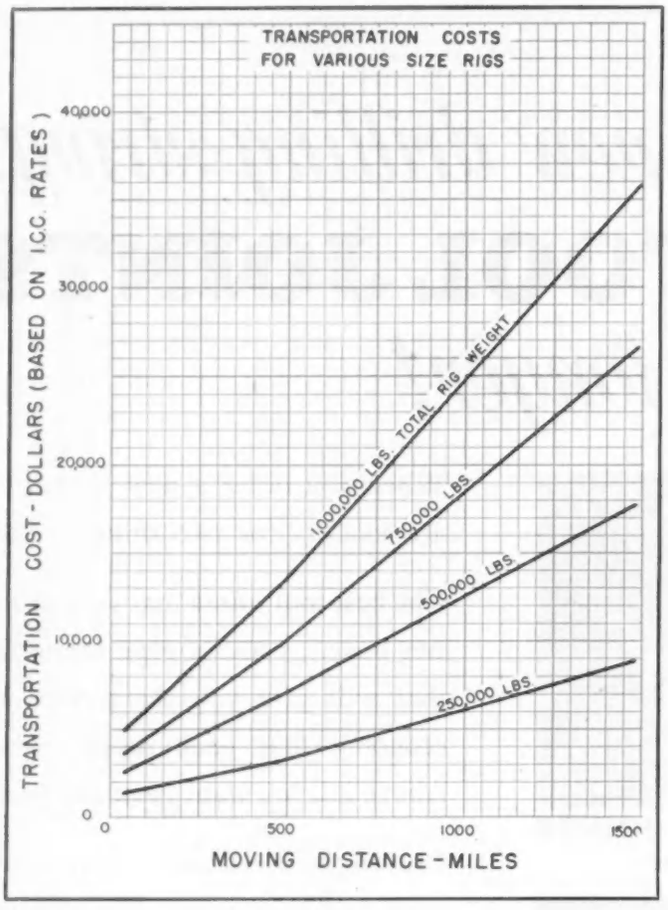

FIGURE 12

formation areas are the 8⅝ inch, 8¾ inch, 9 inch and 9⅞ inch bits.

High rates of penetration in soft formations require higher annular velocities for removal of larger cuttings. Large bits and drill pipe are often desirable from the standpoint of avoiding excessive pressure losses in the circulatory system. Controlling these losses becomes more important as drilling depth increases.

Popular hard formation sizes. When drilling with a rock bit in hard formations, the available drill collar weight is often insufficient for obtaining the most effective performance from larger bits. Under present drilling practices the 6¾ inch, 7⅞ inch, 8¾ inch and 9 inch bit sizes represent the most popular range.

With present trend of increasing weight per inch of bit diameter, bit sizes smaller than 7⅞ inch might be omitted from future popular bit size range, where conventional fluids are employed as circulating medium. The lower tooth heights and reduced bearing area per inch of diameter of smaller bits greatly impair their performance with high weights.

Hole problems. The foregoing has discussed some of the disadvantages which are inherent in the design of small diameter roller type rock bits. Other problems arise from the use of small bits and should be evaluated when a smaller hole size is being considered. Some of these are enumerated here.

1. The pressure drop per foot of hole due to the fluid circulation becomes greater as bit size is reduced. This is due to the limitations that are imposed upon both the maximum outside diameter and the minimum inside diameter of the drilling string. (See World Oil, Slim Hole Report, May, 1954.)

2. Closer control must be maintained over the physical properties of the mud. Filter cake thickness and viscosity must be maintained at a minimum.

3. The amount of effective drill collar weight per inch of bit diameter that can be applied to a rock bit decreases at an accelerated rate with hole size. For a given length of drill collar string, the greatest possible weight per inch of bit diameter is approximately proportional to the square of the hole diameter.

4. The smaller holes usually require more drilling days. The risks which result from fishing jobs, worn casing strings, derrick settling etc., increase rapidly with added days in the open hole.

5. Fishing jobs become more hazardous in the small holes because of the reduced clearance between the drill string and the walls of the hole.

6. The problem of bottom hole pressure changes resulting from running and pulling drill pipe and running casing of the same sizes becomes more critical as hole size is reduced.

7. Smaller casing and tubing strings are necessitated for drastic hole size reductions. Smaller tubing and casing strings sometimes cannot be tolerated due to completion and workover problems.

8. The ability to maintain a straight hole decreases rapidly with drill collar size because the stiffness of an unstabilized drill collar string is proportional to the fourth power of the collar string diameter.

As will be shown later, **the use of smaller holes is advantageous in some cases from an over-all economic standpoint.** Also, although rock bit performance decreases with hole size, the effectiveness of certain specialty bits such as the diamond drilling and core bits together with certain drag type bits, is not affected by reduction in size.

Problems encountered in larger sized holes. The major problems presented by larger holes are not attributed to bit size but to the size of the drilling rig equipment. One big cost item associated with heavy rig equipment is rig transportation. This is illustrated in Figure 12, which shows the effect of rig size on transportation costs from one location to another. This factor should be carefully considered when planning a "wildcat" well or a "small" lease development program situated many miles from where rigs are located.

Another problem confronting larger rigs is that of rigging up and tearing down. The non-operating time on a shallow or fast drilling, deep well becomes such a large proportion of the total number of location days that the larger rigs drilling a large hole cannot compete with smaller and more portable rigs drilling a small hole.

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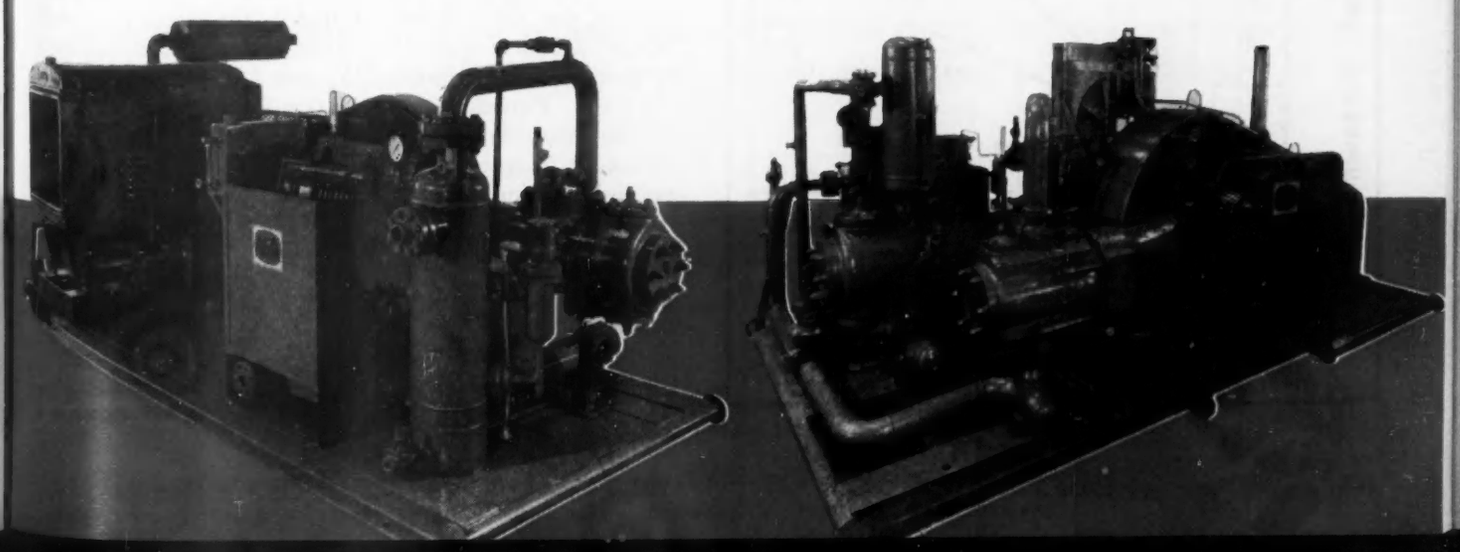

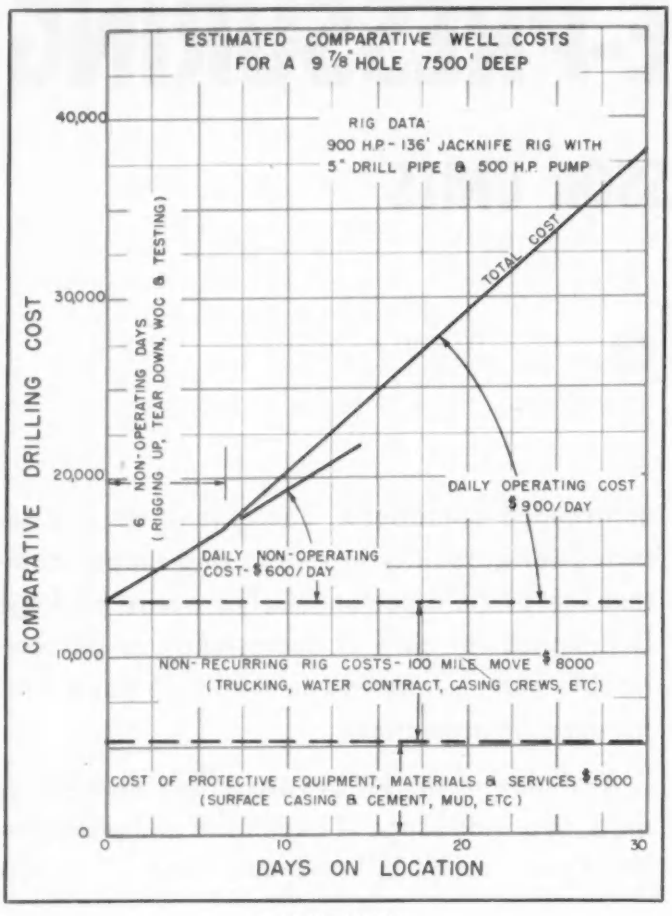

FIGURE 13

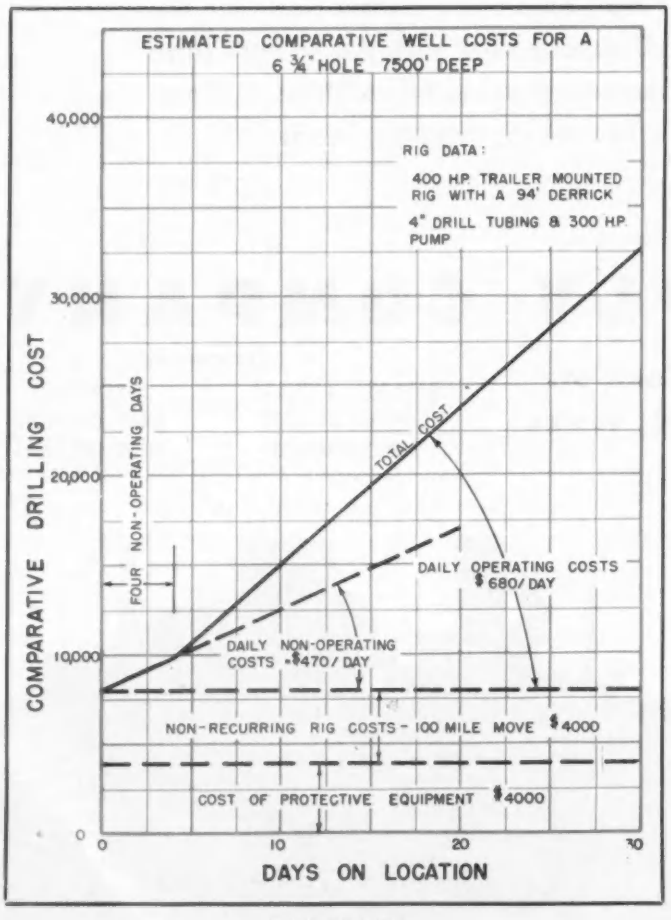

FIGURE 14

Transportation and rig up costs alone predicate future design and selection of land based rig equipment emphasizing higher speed, lower weight, more portability and lower cost equipment.

Relating hole size and rig equipment to total well cost. As stated previously, **the selection of casing and hole size programs should be based on a compromise among those factors which will result in least total well cost.** The casing and hole size program along with the selected drilling equipment are primary factors which govern total well cost. The following is one method of determining the optimum arrangement between these two factors. This economic analysis between rig equipment and hole and casing size program is not too rigorous and should not be considered as such.

As an example, a "wildcat" test well is to be drilled to 7500 feet in an area having only one possible zone of production. This zone will be drill stem tested and the well will be logged at T.D. Also, near the proposed well a 9⅞ inch dry hole that required only 11 bits and 10 drilling days (2 trip days + 8 rotating days) using an 800 horsepower rig. This test well will be located approximately 100 miles from the closest concentration of drilling rigs.

Suppose the operator has a choice between two rig types. When drilling to 7500 feet, the smaller and more portable type rig is limited to 6¾ inch hole operations, whereas the larger rig can and generally does drill 9⅞ inch holes. These two rig types are described in Figures 13 and 14 along with graphical cost analyses for the 9⅞ inch and 6¾ inch hole sizes respectively.

These analyses are similar to the ones presented in Part 1 of this series except for the addition of those costs attributed to surface and intermediate protective equipment. These additional costs include well head equipment, surface and intermediate casing strings, drilling mud, cementing services, floats, shoes, etc. The cost of logging and testing services are not included because these costs are only slightly affected by changes in hole size.

It is estimated that a contractor, using the large rig corresponding to Figure 13 can drill a 9⅞ inch hole to 7500 feet in 16½ location days (10 drilling days). Comparative cost of this well could be $26,000. If a 6¾ inch hole could be drilled in the same number of location days (12½ drilling days), using the smaller rig, the total cost would be $18,500. The net savings that could result from drilling the 6¾ inch hole would be $7500. In this comparison, the 9⅞ inch hole drilled by the larger rig would not be the most economical hole size until the 6¾ inch hole operations exceeded 27½ location days (23½ drilling days). Providing the oil casing string and other completion requirements could be satisfied, a smaller hole would be in order because of the more favorable competitive position of the smaller rig.

On the other hand, had the larger rig been located within "skidding" distance of the proposed well site the competitive positions of the two rigs would be more nearly equal.

For more on slim hole drilling and its application for air drilling see WORLD OIL's May, 1954, issue. Part 4 of this series will appear in a coming issue of WORLD OIL.

Wire Rope at Work—Hard at it near Alice, Texas, the J. B. Vassey Drilling Company was working at 5600 ft when the photographer took this picture. It was a job on which excellent progress could be made with a 96-ft mast and other lightweight, streamlined equipment.

The rotary line was 1-in. 6 x 21 Seale—Form-Set (preformed) Bethlehem Purple Strand with independent wire rope core. To allow reserve for cutoffs, plenty of extra rope was kept on hand, and some of this you see on the reel in the foreground. Here, at the moderate depths involved, the 1-in. rope proved an excellent choice, easily handling the stand of drill pipe and other loads assigned to it.

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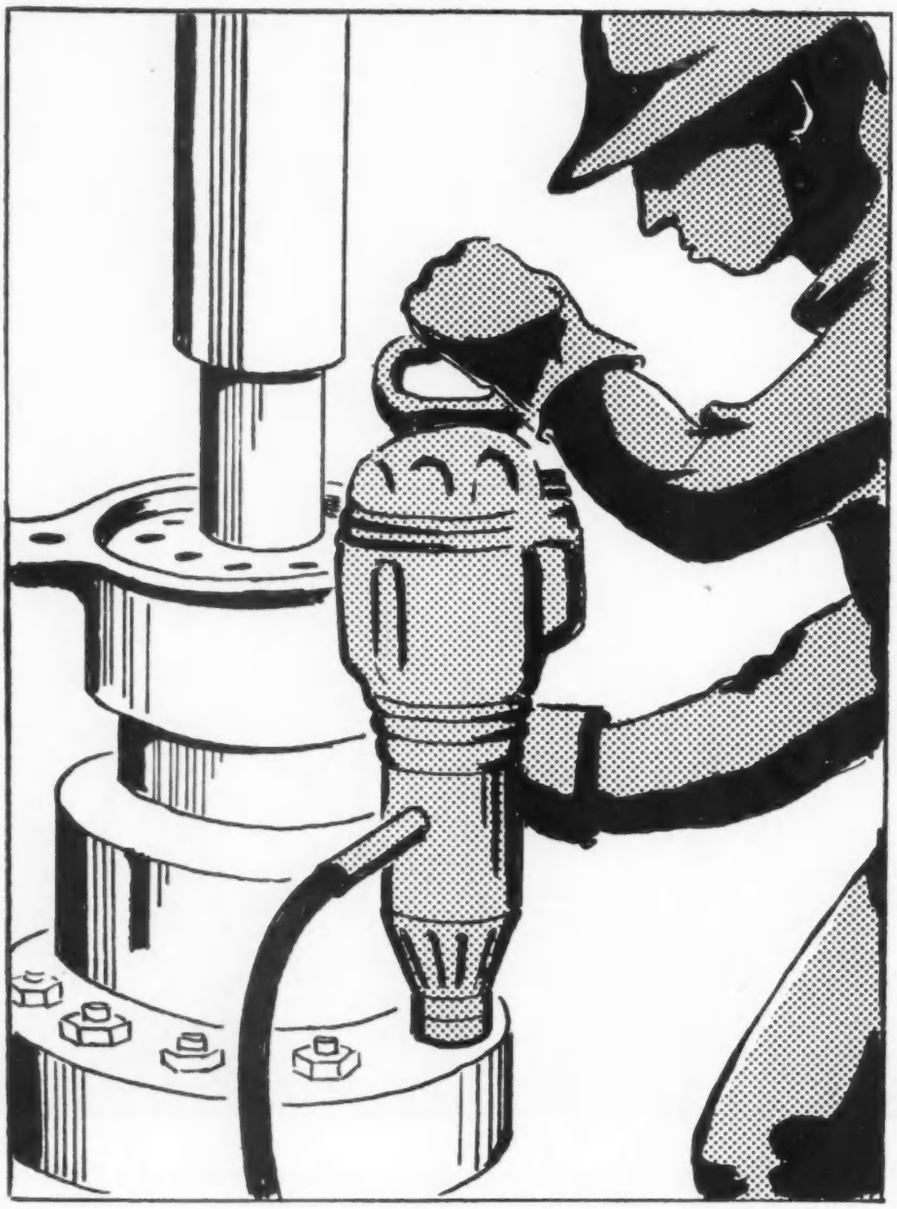
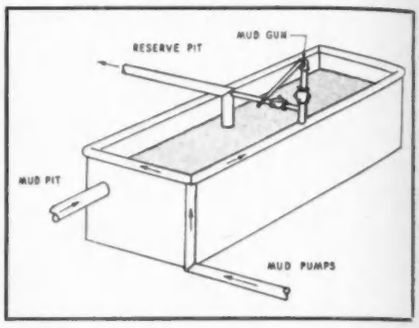


Air Wrench Facilitates Rapid Assembly

Contractors in West Texas and Gulf Coast regions have found that air wrenches lend themselves to rapid assembly and disassembly of equipment, which normally would require several manhours.

One drilling contractor has found that air wrenches greatly facilitate the removal of blowout preventer studs and effect savings on their operations; while another contractor has used the air wrench to advantage by tightening up bolts in the substructure and drilling mast.

Air wrenches can be plugged into the rig air supply and will pay for themselves in a relatively short preiod.



Unitization Eliminates Excessive Mud Piping

One Gulf Coast drilling contractor has welded four-inch pipe to the periphery of the steel mud pits, as shown. This unitization has eliminated excessive mud piping around the rig.

By circulating the mud through the piping system shown, it is possible to use the mud gun or to jet mud and shale over the side into the reserve pit by turning the valve indicated.

The major disadvantage is that a leak in the piping system will shut down the jetting operation until a welder repairs the hole.

A savings in loads, piping and rig-up time has resulted from the use of this integrated system.

Rule for Estimating Volume in Mud Pit

For each 100 square feet of area of pit, there are 1½ barrels of fluid for each inch of depth.

Example:

Mud Pit: 10 ft. wide
30 ft. long
6 ft. (72 inches) deep
Area = 10 feet by 30 feet = 300 square feet
Volume = 3 by 72 x 1½ = 324 barrels
Actual volume = 320 barrels
Accuracy = 98.8 percent

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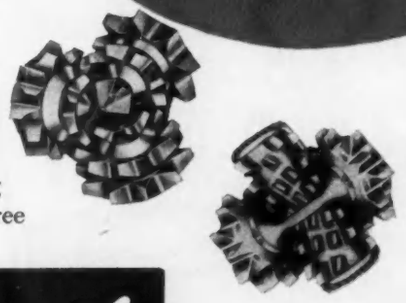
When you want *fast* digging in top formations (and who doesn't?) these are the bits that really deliver! The long teeth, of field-proven design, and the rugged construction give you more hole per hour, plus longer time on bottom. And these tough bits not only make fast, straight hole in chalks, red beds, and unconsolidated sands, but they also do well in anhydrite, the medium-soft limes and in formations with harder streaks and stringers when appropriate weights and speeds are employed.

H. C. Smith long-tooth bits are available in either three-cutter or four-cutter models, with either regular or jet-action circulation. Like all H. C. Smith bits, they feature all-forged bodies, hard-faced cutter teeth and triple-bearing construction for long, trouble-free service life.



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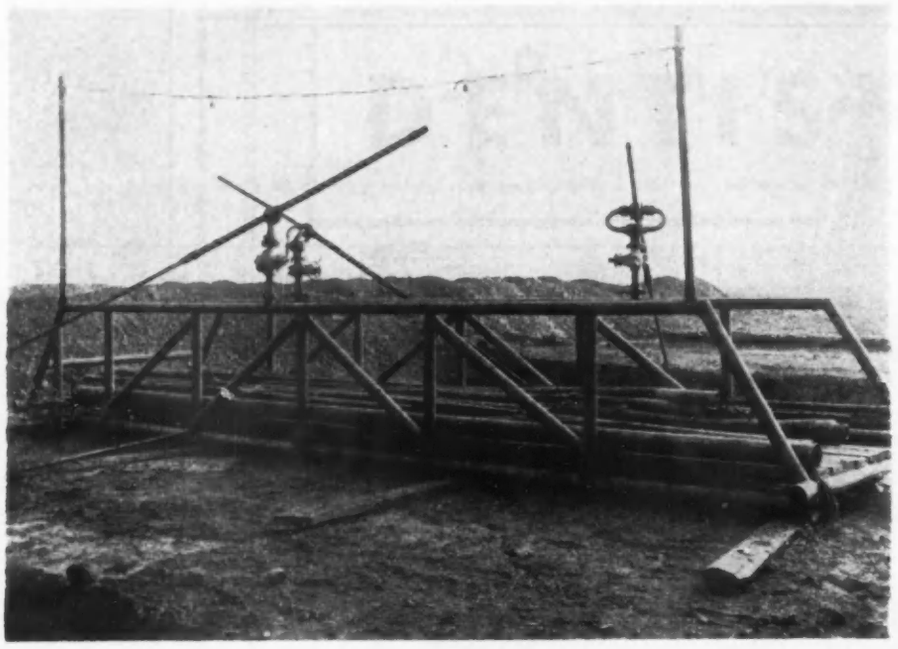


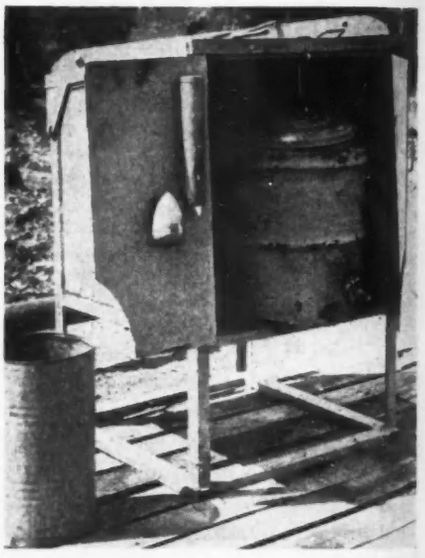
Multiple Purpose Pipe Skid Is Useful

One Gulf Coast drilling contractor has used ingenuity in designing a pipe skid, or junk box with built-in mud guns, and electric light standards. The unitized equipment holds many advantages for a contractor with small compact rigs that must conserve loads.

The mudline at extreme left discharges the mud into the pipe base of the skid where it is circulated to the top horizontal member; then it discharges through the mud gun which has been welded in an upright position as shown.

Note that standards for lights are made by welding a two-inch pipe coupling to the top side of the horizontal member. A length of pipe with electric wire strung can be screwed into the coupling to form a support for lighting system.

The pipe skid can be placed between two earthen mud pits with necessary fittings for mudlines on the skids. It is a simple matter for the crew members to hook up the jet lines and start "gunning" the pits as needed.



Steel Cabinet Protects Drinking Equipment

One major company in the Gulf Coast area has fashioned a cabinet one of one-eighth-inch steel plate, which shields the rig drinking water, drinking cups and salt tablets.

Steel frame work is welded out of 1½-inch angle iron with sheet metal welded to the frame. A hinged door accommodates the paper drinking cups and salt tablets as shown. Note the elliptical shape cut out of each of the doors to permit the doors closing on the rounded portion of the water tank inside without damaging the water faucet. On the top a reinforced steel brace with a transportation lug is provided so that the unit may be picked up by a winch and hauled to the next location.

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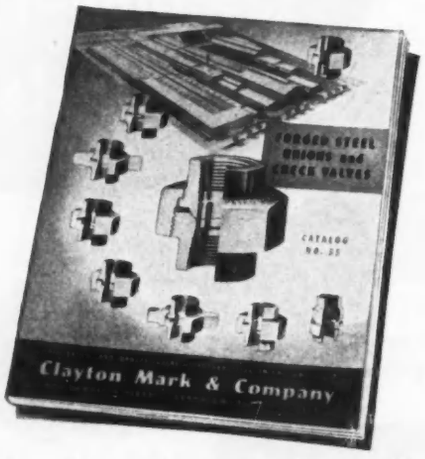

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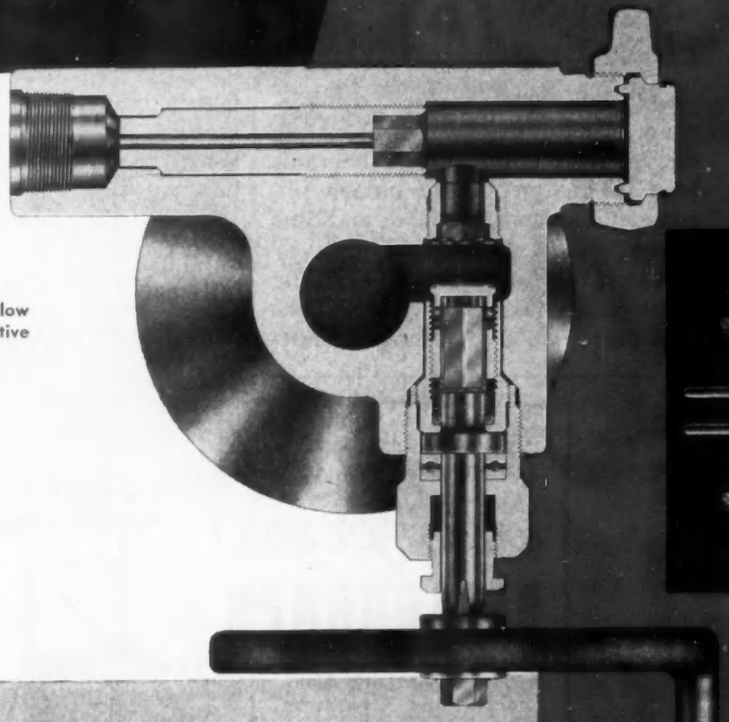
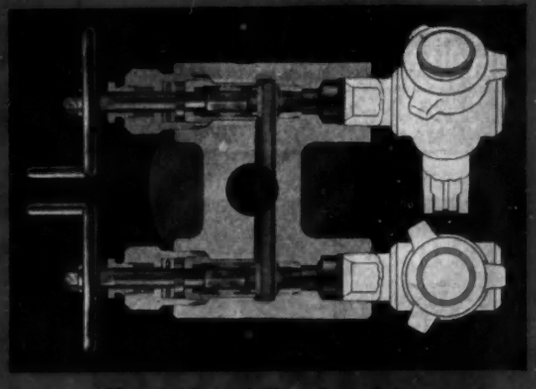


Top View — "JE" Flow Control with Positive Choke.



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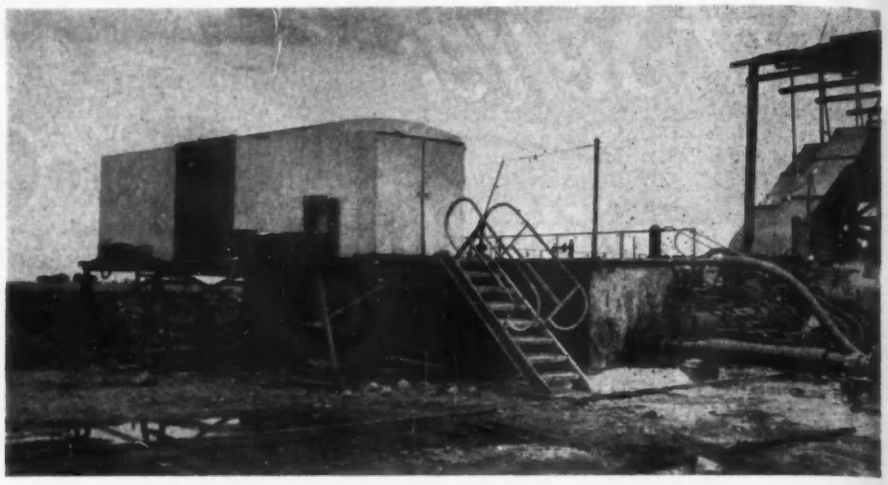

Elevating Mud Storage Room Aids Crew

One major company in the Permian Basin found that by elevating the mud storage room to the same level as the top of the suction pit, considerable savings in labor and time results.

A steel building with double sliding doors on each side has been popular with the rig crew. By raising and resting the building on three pipe horses, the sacked mud can be transferred at truck height to the inside of the building.

The steel horses are fabricated from junk drill pipe welded in the well-braced saw-horse shape shown. The skid-mounted building is set in place on top of the horizontal braces of the

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Mud Hopper in Pump Base Saves Time in Rigging Up

One Gulf Coast drilling contractor has welded and unitized the mud hopper into the I-beam skid base supporting the mud pump.

In an effort to eliminate the hauling of excessive lengths of connection pipe for the mixing of mud, this contractor has made use of a short jet line near the pump which results in excellent homogenous mud mixtures.

Dual lines on either side of the pump make it possible to connect and move hopper in position on either side of pump. A further advantage is noted in that the mud is stored on the side away from the mud pit.

Such a hook-up saves time in rigging up and minimizes the number of loads usually required when quantities of piping are required about the rig.

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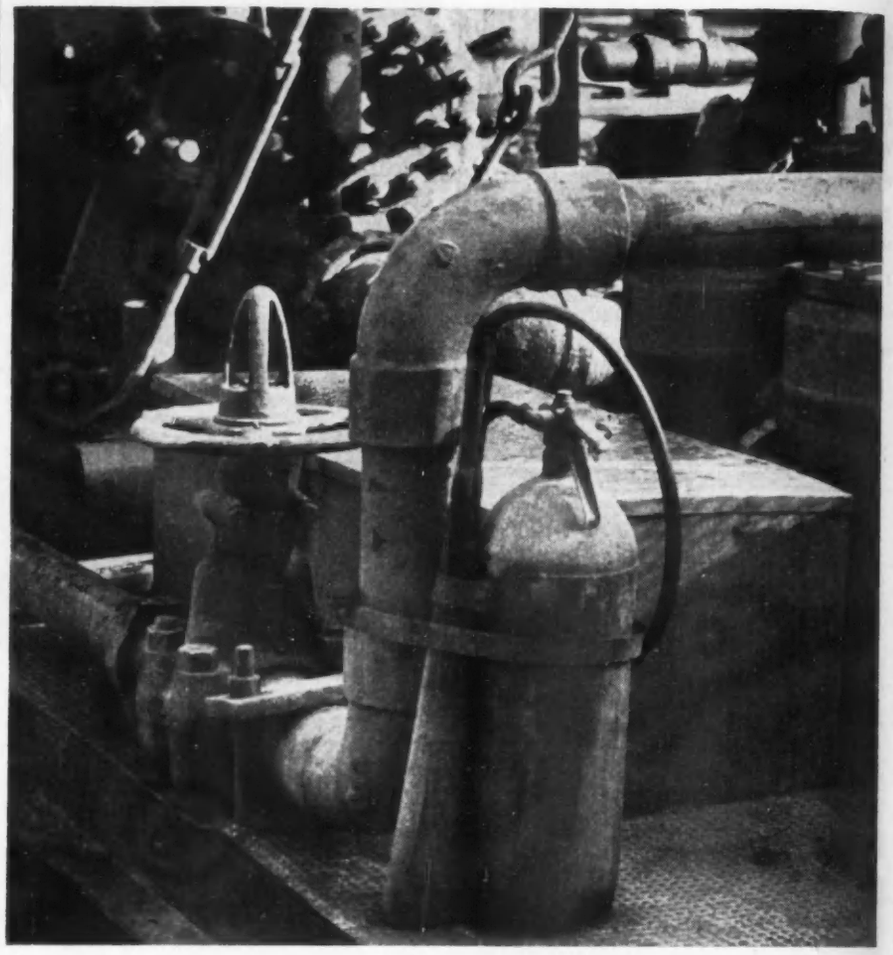

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E. L. Bass Drilling Company of Houston has adopted a desirable safety practice. By positioning fire extinguishers at strategic spots on the

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A steel band looped around the extinguisher, and any rigid piece of rig equipment as shown, may ultimately be the difference between low and high insurance rates.

Fire extinguishers are valuable to contractors only if they are kept in proper working condition and are placed where crew members can use them quickly in case of an emergency.

Light Bulb Is Effective In Heating Coffee Pot

On one of Helmerick & Payne's rigs in the Williston Basin area, the mud man has won the praise of the crew for his device which keeps the coffee at the right temperature. A 500 watt light bulb under the pot prevents the use of open flame around the rig and is effective in heating coffee since the bulb gives off a considerable amount of heat.

The simple pot holder was made by

cutting a hole in a channel iron under the exhaust pipe on the engine and dropping in the light bulb. A "stove" made of a short length of ten-inch pipe with a steel plate welded inside near the top to hold the pot completes the assembly.

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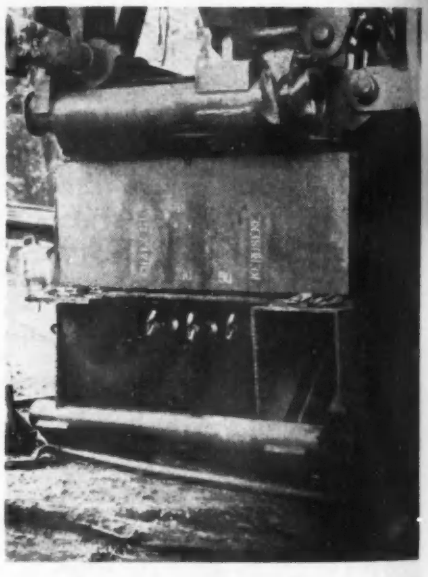
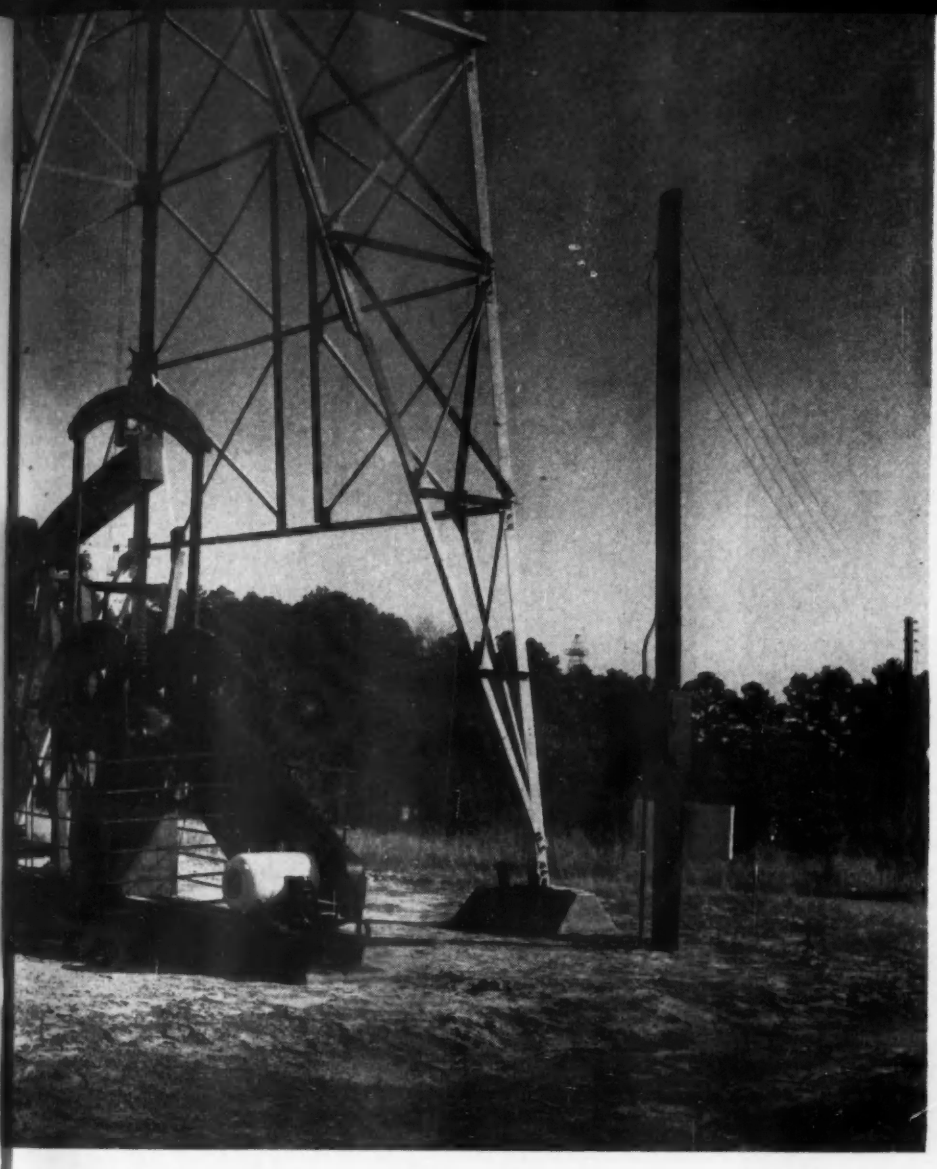


Integrated Fuel Tank Cuts Down on Loads

One Gulf Coast drilling contractor has unitized the fuel tank into the back end of the rig sub-structure as shown.

Refueling is by outlet connection on the top, not shown. The spigots shown are for withdrawing the desired fuel which is plainly stenciled about the proper outlet.

This integrated fuel tank cuts down on the number of loads required to haul the rig, yet offers a convenient out-of-the-way location for fuel storage.



GRAPHIC WATTMETER is used to balance the operating cycle of electrically-powered pumping units equipped with time clock controls.

Graphic Wattmeters Used To Balance Pumping Cycle

Reduction in power costs per barrel of fluid produced from electrically-powered pumping wells has been the result of balancing or 'matching' the operating cycle of a pumping unit with the producing capacity of a well.

By REX N. BROWN, Southwestern Public Service Company, Lubbock, Texas

THE OPERATING CYCLE of an electrically-powered pumping unit can be adjusted with the aid of graphic wattmeters to bring about a considerable decrease in electric power consumption per barrel of produced fluid. This has been done in the South Plains area of Texas without a loss in total production, and in many cases, a net gain in production has been realized.

The problem has been one of "matching" or balancing the on-off cycle of the pumping unit to the productive capacity of the well. In doing this, the load on the pumping unit is near constant during its operating cycle. Result is to minimize the electrical energy demand for the pumping unit. Electric power supplied a pumping unit on a well that has "pumped off" (lack of fluid in the well bore) does no work, with the net result that the electrical cost per barrel of fluid pumped is higher. Application of this method of balancing the time cycle of pumping wells has made possible the economic operation of marginal wells with low gas-oil ratios and low bottom-hole pressures.

Many factors involved. It was known from the beginning that many factors were involved in accounting for abnormal bills on leases where there is a problem of making the lease production allowable. Only two factors are considered here: (1) operating a well out of balance; and (2) operating a well after it is pumped off, or both.

By a systematic study of the instantaneous current in each phase at the well, it readily was determined that the problem was not only one of balancing the well properly, but it was necessary to know when to do the balancing. Previously, when a customer was informed he should balance at maximum production times, he immediately would say that flow meters and men simply were not available for such tests. Needed was something which could be used as a tool and not as a crutch in working with producers with this type problem. This problem prompted the study that solved several questions, especially for the small independent operator.

Since an electric company does not have production equipment available, it was necessary to use electrical equipment that would give essentially the same information as that obtained by production testing equipment.

To provide the required data, a thermal-type graphic demand meter with a 48-hour chart was used. The thermal meter was selected because of its simplicity, sturdiness, and the fact that thermal meters are not troubled with indicator swing that always is present in magnetic instruments when testing oscillating loads such as individual beam pumping units.

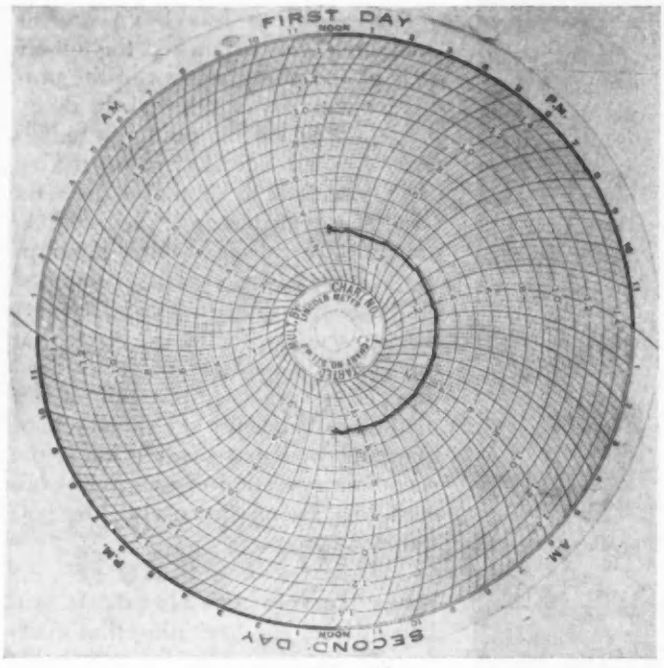


CHART 1—Troubled well in Seminole field. Continuous 24-hour operation used excessive electric power. Maximum demand was 6.8 kilowatts. Energy cost per barrel was 3.28 cents.

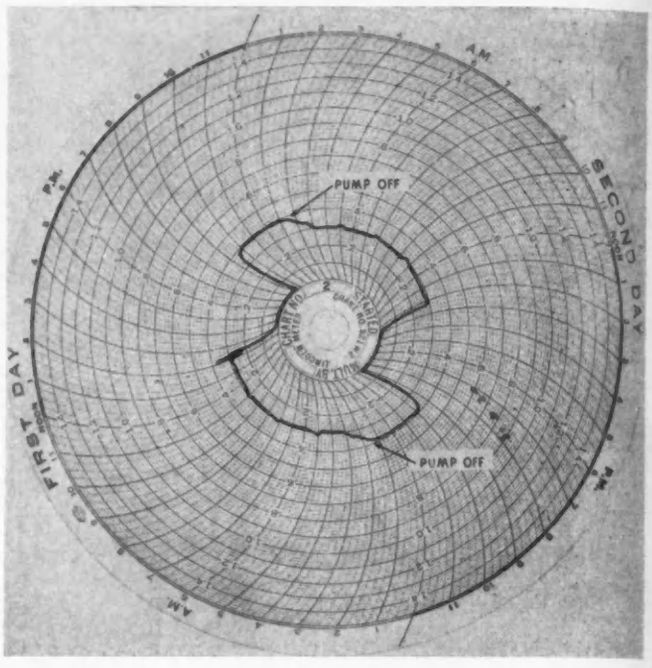


CHART 2—First trial to balance pumping cycle. Well was operated for 17 hours, then off for 7 hours. Well began to pump off after four hours. Maximum demand was 9.5 kilowatts on this 48-hour chart.

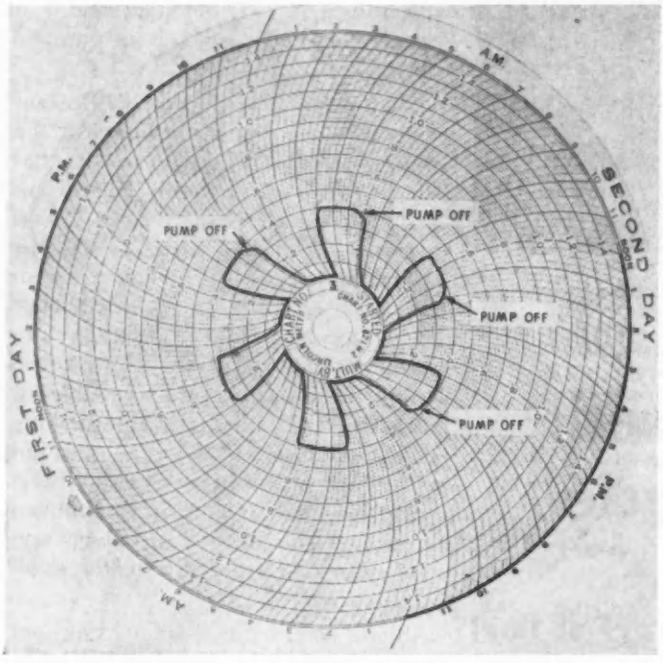


CHART 3—Second setting was 3½ hours on, 4½ hours off. Well pumped off at end of 2½ hours. Maximum demand was 9.5 kilowatts on this 48-hour chart. Power costs were 2.16 cents per barrel.

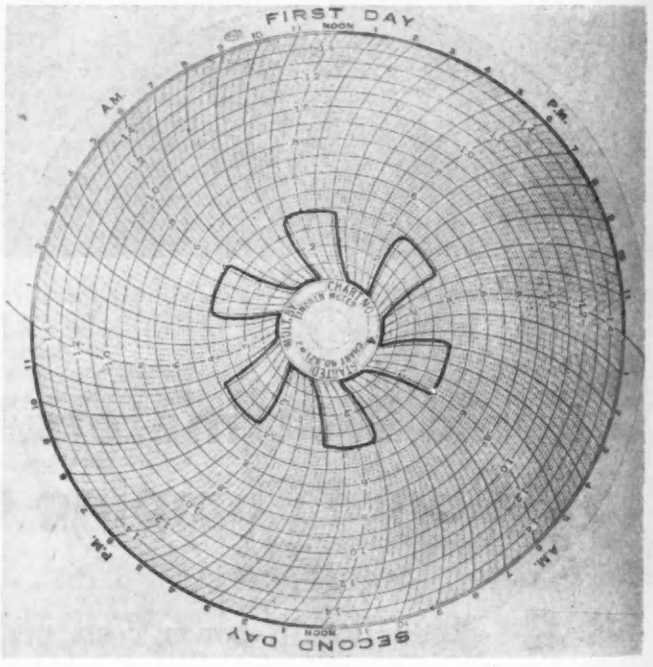


CHART 4—Final time cycle was 3¾ hours on and 4½ hours off. Maximum demand was 9.6 kilowatts, but production increased from 68.35 barrels to 69.03 barrels of oil (plus 5 percent water in both cases). Electric power costs for this setting was 2.10 cents per barrel, a reduction of 36 percent over continuous operating cycle.

The kilowatt meter was chosen over the ammeter because it was important to obtain an indication of the change in power used by the well under operating conditions. It was known that the thermal ammeter would not give a true picture of the power input to the well because of the electrical characteristics of an induction motor under varying loads. Also, by integrating the KW chart, the KWH consumed can be determined. Since most oil field distribution in this area is at 480 volts, a 480-volt KW meter was selected. Two multiple tap current transformers were mounted in a box with the meter for ease in connecting to different sized loads. Many tests were conducted over the South Plains of Texas, but only two of the more interesting ones will be discussed.

Field tests. The instrument was placed on a 20-horsepower electrified well in troube in the Seminole field, where little gas was present. This well, which we will call test well "A," was being pumped around the clock, and chart number 1, test number 1A was made under normal operation. By in-

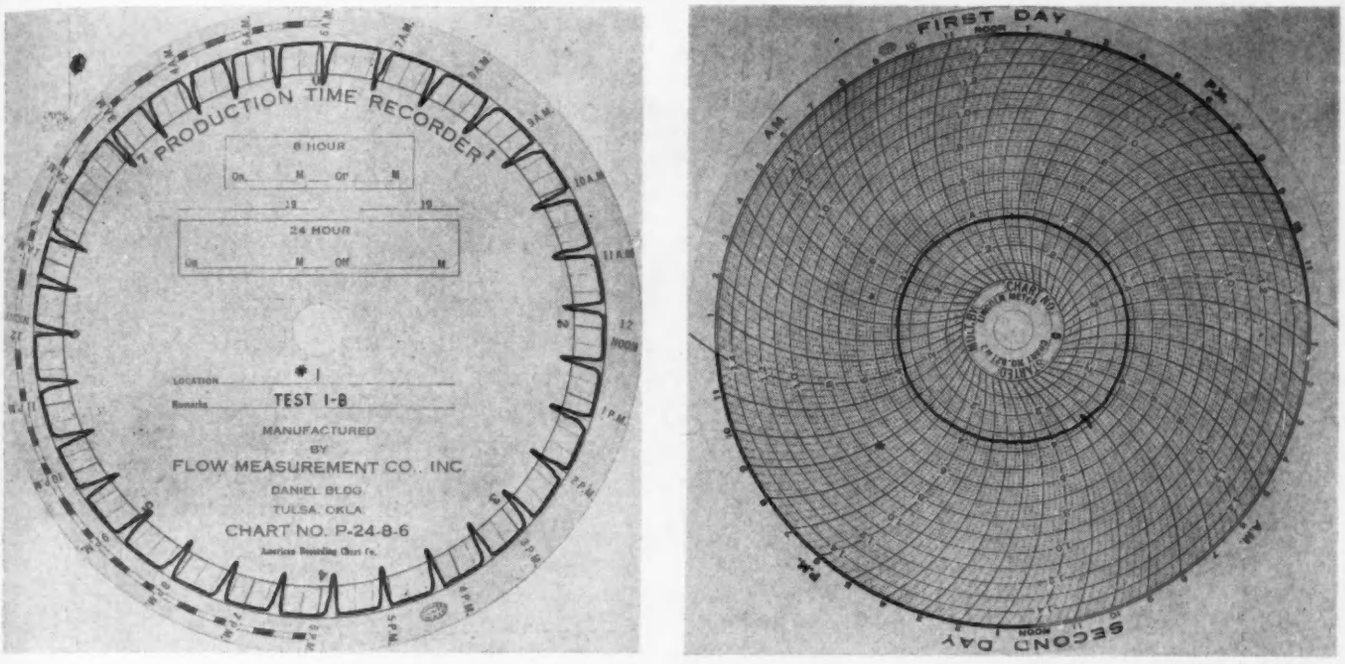


CHART 5—Interesting case in Cedar Lake field, tested first under regular 24 - hour operation, using 48 - hour charts on wattmeter (right). Maximum demand was 3.8 kilowatts. Production: 31 barrels fluid per 24 hours. Power cost: 3.89 cents per barrel. Production time recorder chart at left indicates time separator dumps.

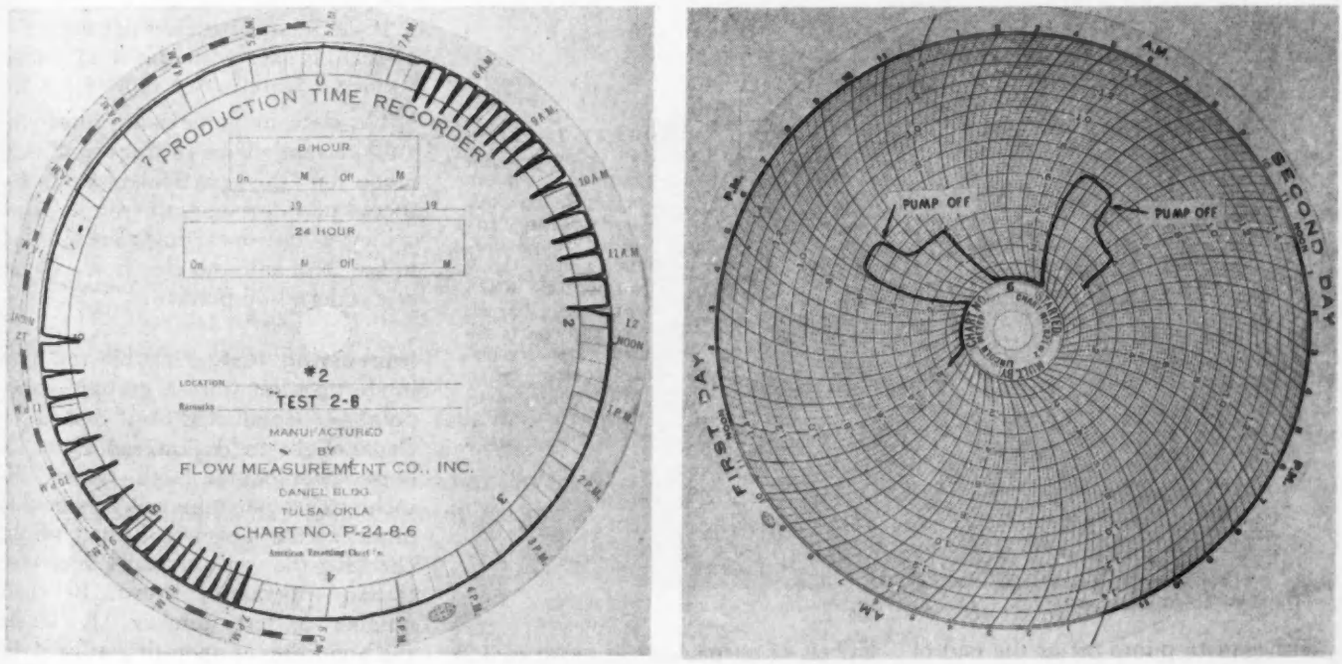
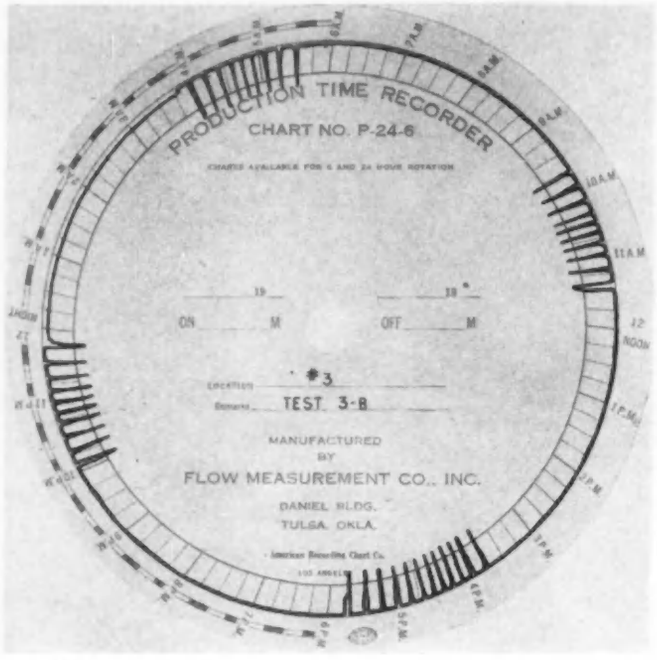


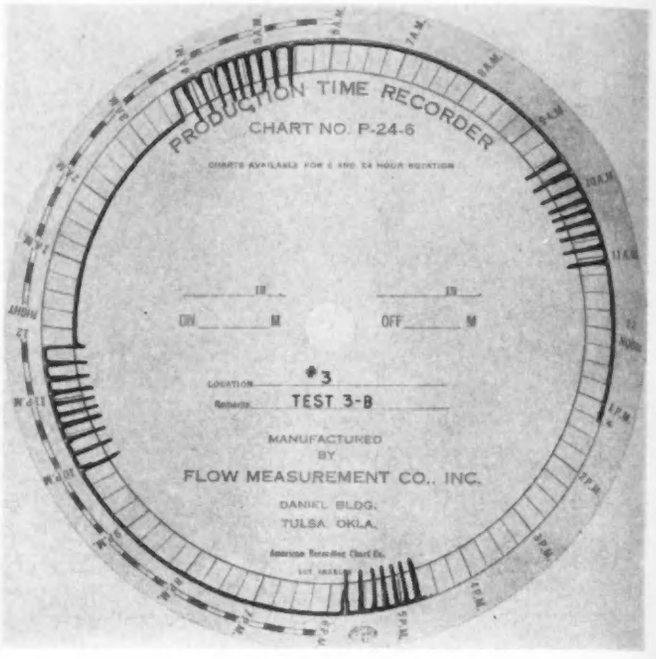
CHART 6—Operating cycle on preceding case was changed to 5 hours on, 7 hours off. Maximum demand was 6.8 kilowatts on a 24-hour chart. Production increased from 31 barrels to 34 barrels at a power cost per barrel of 1.88 cents.

tegrating the KW chart, it was found that the energy cost per barrel of oil amounted to 3.28 cents in the 24-hour operation, with a demand of about 6.8 KW as shown under the tabulated results of test well "A."

The producer cooperated to the fullest extent and changed the time settings as required for the test. For the first trial, the time clock was set for 17 hours operation and 7 hours off, as indicated in chart number 2, test number 2A. From a close observation of KW demand chart number 2 and production gaging, it was determined that the well had begun to pump off after about 4 hours and then for 13 hours the well pumped much less oil. (Note the pump off point marked on the KW charts.) Even though the demand was lower, the KWH requirement per barrel of fluid was much higher during this 13 hour period because of loss in efficiency of the equipment, part of which was due to the fact that the balance of the pumping unit was thrown off when the oil to be lifted decreased. This loss in efficiency tends to increase the demand due only to the operation of the unit and the pump itself. This is more than offset, however, by the fact that there is much less oil to be lifted, which means less actual work to be done and thus a smaller power requirement as is indicated on the KW demand charts. This made it more expensive to lift each additional barrel of fluid.

The next setting, it was determined, could logically be 3½ hours on and 4½ off. With this time setting, the





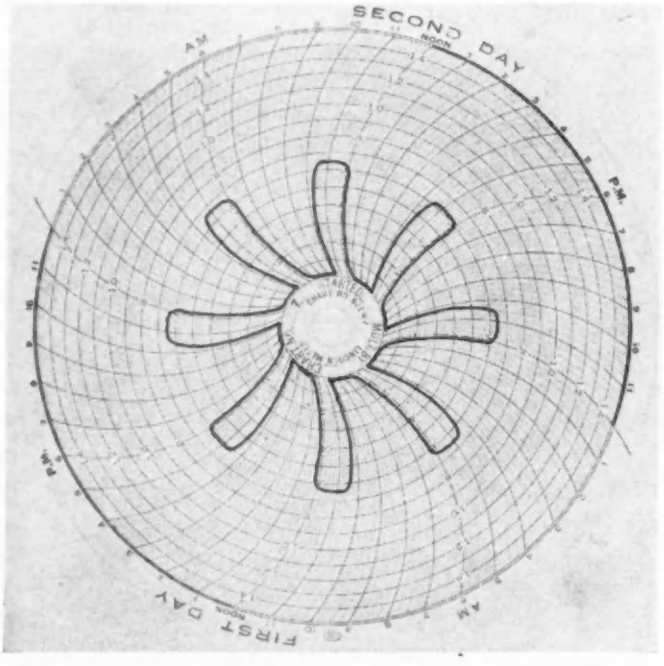


CHART 7—Time cycle changed again to 2 hours on, 4 hours off. Production increased to 38 barrels, power costs dropped to 1.375 cents per barrel. Two top charts record time separator dumps. Both are 24-hour charts. Wattmeter chart at left is 2-day chart.

well began to pump off at the end of 2½ hours, as is indicated on chart number 3, test number 3A. However, after about 36 hours of this cycling, the build-up in production was such that the well ceased to pump off at any time, as is indicated in the latter hours of chart 3, where there is no pump off point. (KW demand remains constant.) In the final analysis of this particular test, the settings were 3¾ hours on and 4¼ hours off, as shown on KW chart number 4, test number 4A. With these settings, the well never pumped off and the unit was in balance at all times. At the beginning of this series of tests, the well was pumping approximately 68 barrels of oil per day at a cost of 3.28 cents per barrel for electric power.

At the end of the tests, the well was pumping approximately the same amount of oil at a cost of 2.10 cents per barrel, a reduction of 36 percent. In other words, the well was producing at a high rate, and the unit was in balance during the entire 3¾ hour operating period. In this particular case, the stroke was not changed. The well was set at 17 strokes per minute—54-inch strokes with the fluid testing 5 percent water. (See table 1.)

The data in Table 1 are representative of many time settings that were made on this particular well. No spectacular production results were achieved, but operating time was cut to less than half and electrical expense was reduced 36 percent.

Interesting test. Probably the most interesting test from a graphic standpoint was conducted on a well in the Cedar Lake field powered by a 15-horsepower motor with twenty 34-inch strokes per minute. As is normal practice, the test was kicked off by checking the well under 24-hour continuous operation, shown in chart number 5, test number 1B. Under this condition of operating around the clock, the results show a picture that, even at a glance, looks bad. In this test which is referred to as test on well "B," a production meter was used instead of gaging. This was very beneficial to the tests since no water was present.

TABLE 1
Tabulated Results from Test Well "A"

TEST	TIME CYCLE		Barrels Oil	KWH Per Barrel	Barrels Per Hour	Cost* Per Barrel
	Hours On	Hours Off				
1A	24	0	68.35	2.34	2.85	3.28¢
2A	17	7	66.63	2.03	3.9	2.79¢
3A	3½	4½	64.41	1.55	6.18	2.16¢
4A	3¾	4¼	69.03	1.53	6.14	2.10¢

* Based on energy charge of 1.375¢/KWH.

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Believe it or not, seat and completely split ball from a pump in a West Texas field. Photo unretouched.

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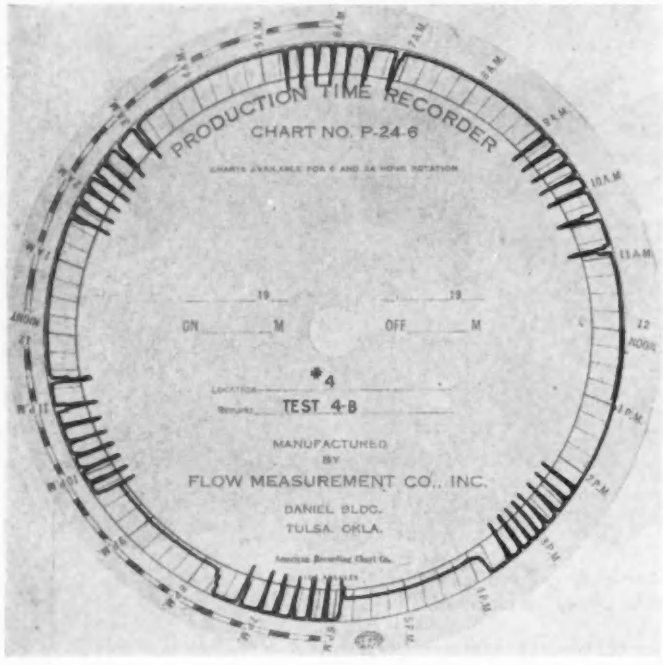


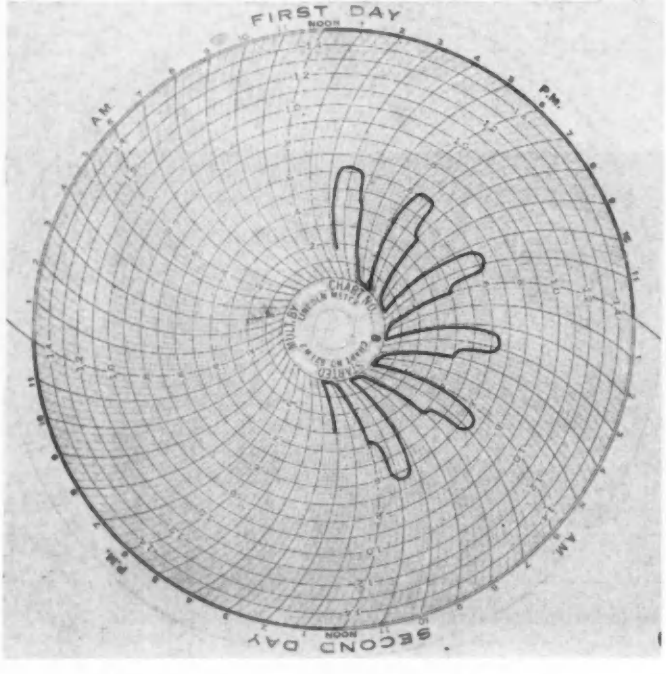


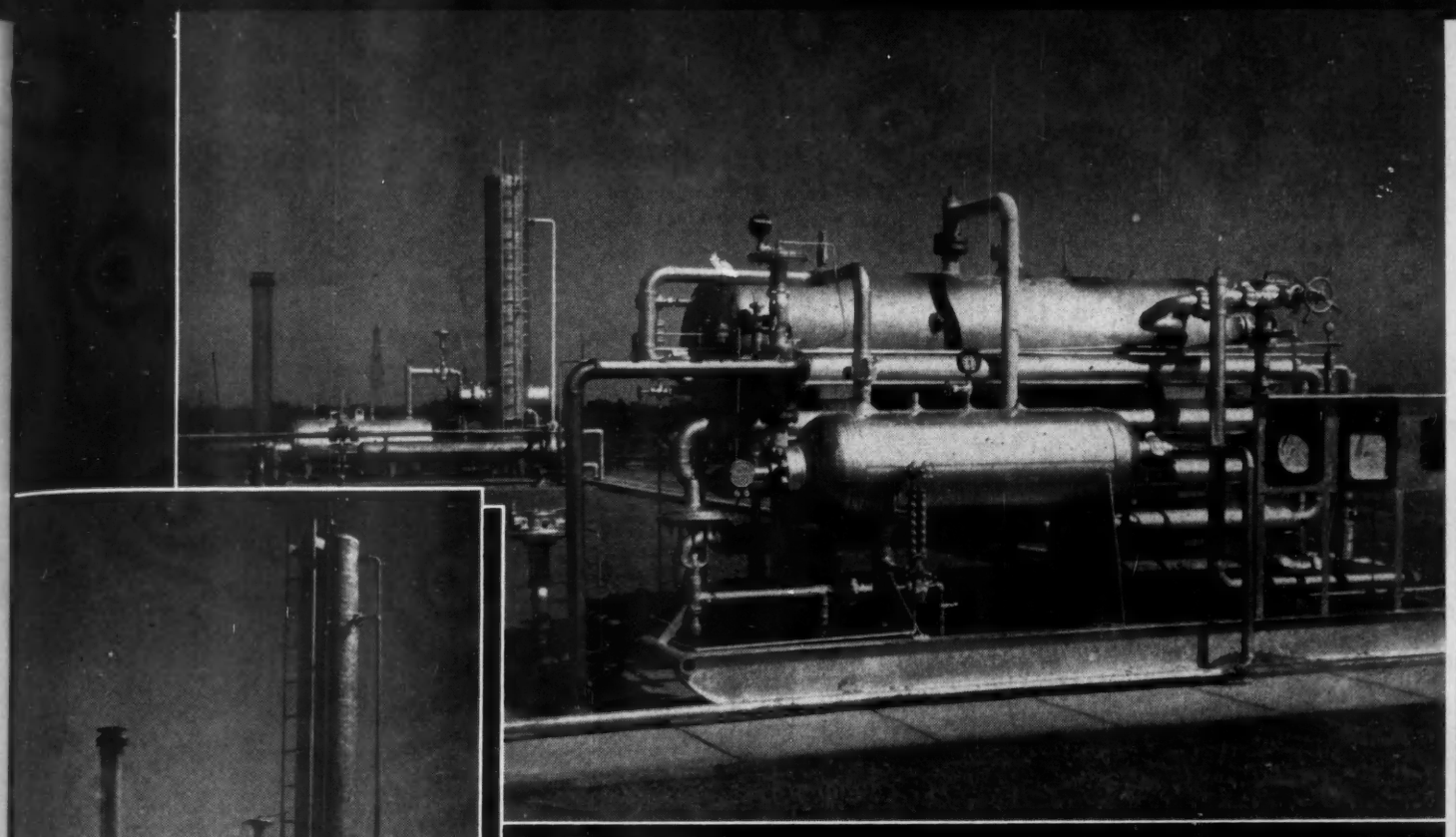
CHART 8—Pumping cycle changed again to 2 hours on, 2 hours off. Production went to 44 barrels on 24-hour test. Maximum demand was 6.6 kilowatts, costs per barrel went up to 1.505 cents.

PUMPER CHECKS time clock controls so necessary in balancing the pumping cycle of a marginal well.

In this initial test, the oil pumped amounted to 31 barrels with an energy use of 90 KWH. This means an energy cost of 3.89 cents per barrel to operate this well. In test number 2B, a time setting of 5 hours on and 7 hours off was used, as indicated on chart number 6. This means 10 hours pumping time per day as compared to the original 24. It is interesting to note in chart number 6 that the rate of production and the rate of electric power used (KW demand) follow the same pattern. The well produced 34 barrels of oil with the use of only 46.5 KWH, or the well produced 34 barrels of oil at a cost of 1.88 cents per barrel for electric service. Even with this improved operation, the demand chart number 6 indicated that the well had begun to pump-off after about 2 hours. This was verified by the production chart.

On the following test, a time setting of 2 hours on and 4 hours off, shown on chart number 7, test number 3B was used. This was a 48-hour test, so the two 24-hour production charts as well as the 48-hour KW demand chart are shown. As expected, there was additional improvement. In this case, 38 barrels of oil was produced at a cost of 1.375 cents per barrel. The production was up almost 25 percent over the original setting and the cost of energy was less than half of what it was before the tests were started.

These results prompted additional study, as shown on chart number 8, test number 4B. In test 4B, the time was left at 2 hours on but the off time was reduced to 2 hours. Production was increased again up to a rate of 44 barrels per day. During this 24-hour period, energy was used at a rate of 1.09 KWH per barrel and production was at a rate of 3.66 barrels per hour. This is a decrease in the production per hour of operation and can be easily explained because the production and KW charts indicate that on



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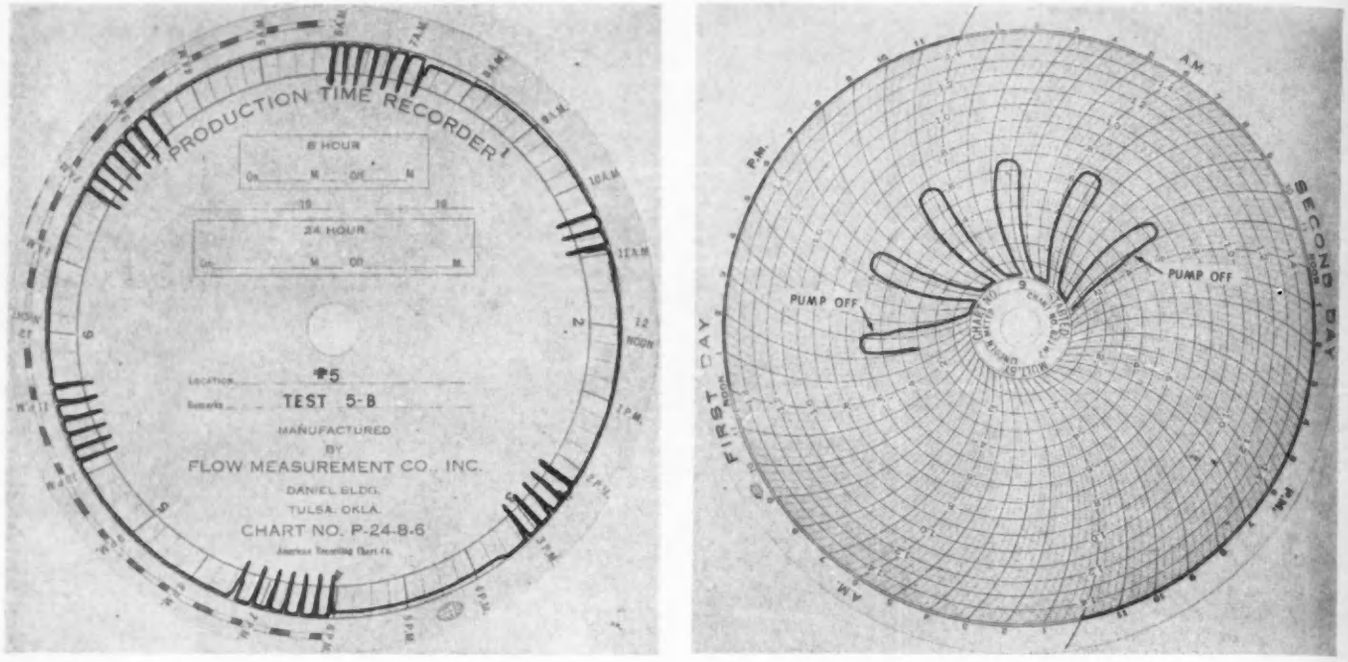

CHART 9—Following day, pumping time was altered to 1½ hours on, 4 hours off. Production dropped to 35 barrels in 24-hour test, power costs went up to 2.18 cents per barrel. Maximum demand was 6.6 kilowatts.

each cycle the well had begun to pump off. We reduced the pumping time the following day to 1½ hours on and increased the off time to 2½ hours, shown in chart number 9, test number 5B. Results of this test was an increase in the cost per barrel as well as decreased production.

Even though costs were less as far as purchased power was concerned with time settings of 2 hours on and 4 off, the customer elected to select the time settings of 2 hours on and 2 off because of the greater production. The final analysis of these tests amounts to an increase in production of from 31 to 44 barrels per day. This is a 42 percent increase in production with the energy cost being reduced 60 percent.

The data in Table 2 are representative of the many time settings that were made on this particular well.

Additional advantages. The main advantages of a properly planned time cycle schedule for marginal wells with low gas-oil ratios are:

1. Increased production.
2. Reduced power operating cost.
3. Lowered maintenance through balanced operation and reduced operating time.
   (a) Prolonged unit life.
   (b) Reduced rod trouble.
   (c) Reduced stuffing box trouble.
   (d) Reduced pump trouble.
   (e) Eliminating pounding.
   (f) Reduced servicing costs.
4. Increased pumper convenience and efficiency.
   (a) Can pump more wells.
   (b) Reduces pick-up mileage.
   (c) Reduces stuffing box clean-up problems.
5. Tends to conserve formation gas because fluid buildup maintains back pressure on the formation.

The producer who utilizes the advantages of time cycle pumping will realize a greater profit from marginal wells through lower operating and maintenance costs.

TABLE 2

Tabulated Results from Test Well "B"

TEST	TIME CYCLE		Barrels Oil	KWH Per Barrel	Barrels Per Hour	Cost* Per Barrel
	Hours On	Hours Off				
1B	24	0	31	2.90	1.29	3.89¢
2B	5	7	34	1.37	3.40	1.88¢
3B	2	4	38	1.00	4.75	1.375¢
4B	2	2	44	1.09	3.66	1.505¢
5B	1½	2½	35	1.58	3.89	2.18¢

* Based on energy charge of 1.375¢/KWH.

About the Author

REX NELSON BROWN, a native of Pampa, Texas, was made utilization manager for Southwestern Public Service Company, Lubbock, Texas, in 1952. Following graduation from Tulia High School, Tulia, Texas, in 1951, he served three years in the U. S. Air Force as flight engineer. After the war, he entered Texas Technological College at Lubbock and was graduated in 1949 with a B.S. degree in electrical engineering. His first job with Southwestern was meter reader, followed in 1950 by assistant industrial power sales engineer and to industrial power sales engineer in 1951. A year later, he was made utilization manager, the post he now holds.

ACKNOWLEDGMENT

Based on a talk given by the author before the 26th Annual Conference, Petroleum Electric Power Association, New Orleans, Oct. 4-6, 1954.

—The End

The men who run these companies are local men in the oil fields. They concentrate on serving a small area more effectively, rather than playing the big field and scattering their efforts. Because they are not run by remote control or bound by rules and tradition, they can make decisions and give answers on the spot quickly. They depend for their livelihood on making the right decisions and having the right answers.

This ability to make decisions fast begins with the suppliers' salesmen and store managers who have lived for many years in day-in-and-day-out contact with the oil men. They often live in their stores, offering 24-hour service on even the smallest items of equipment. They know their customers, know their problems and work with them in a sort of partnership.

"Often drilling contractors and producers hate the smell of ink. We do business with them so they don't have to smell ink," one independent says. If some unusual problem arises, the field store can get a decision from the home office within a few hours.

The owners and other top men for the independents are continually on the move visiting their customers' operations and keeping in touch with their activities and requirements. Their roots go deep in the oil fields.

• **Free Selection**—The independent distributor has an advantage in the range and variety of products he carries for the oil men. Because he is independent, he can select from nearly the entire field of manufacturers and deal with those firms he knows will provide the best in quality and service.

Today, with seamless tubular goods in easier supply, oil men who have become more cost-conscious are depending more on the local distributors because they know they are operating with less overhead. This means continued personal service at prices that are competitive.

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Fig. 1—Modern acidizing techniques have resulted from the combination of laboratory research, field experience and improved field equipment.

Modern practices eliminate guesswork when . . .

Acidizing in Undeveloped Areas

Effective acidizing jobs are the result of careful study and planning. Here's the way to handle the problem in a new area.

By R. E. HURST and D. E. RAMSEY, Dowell Incorporated.

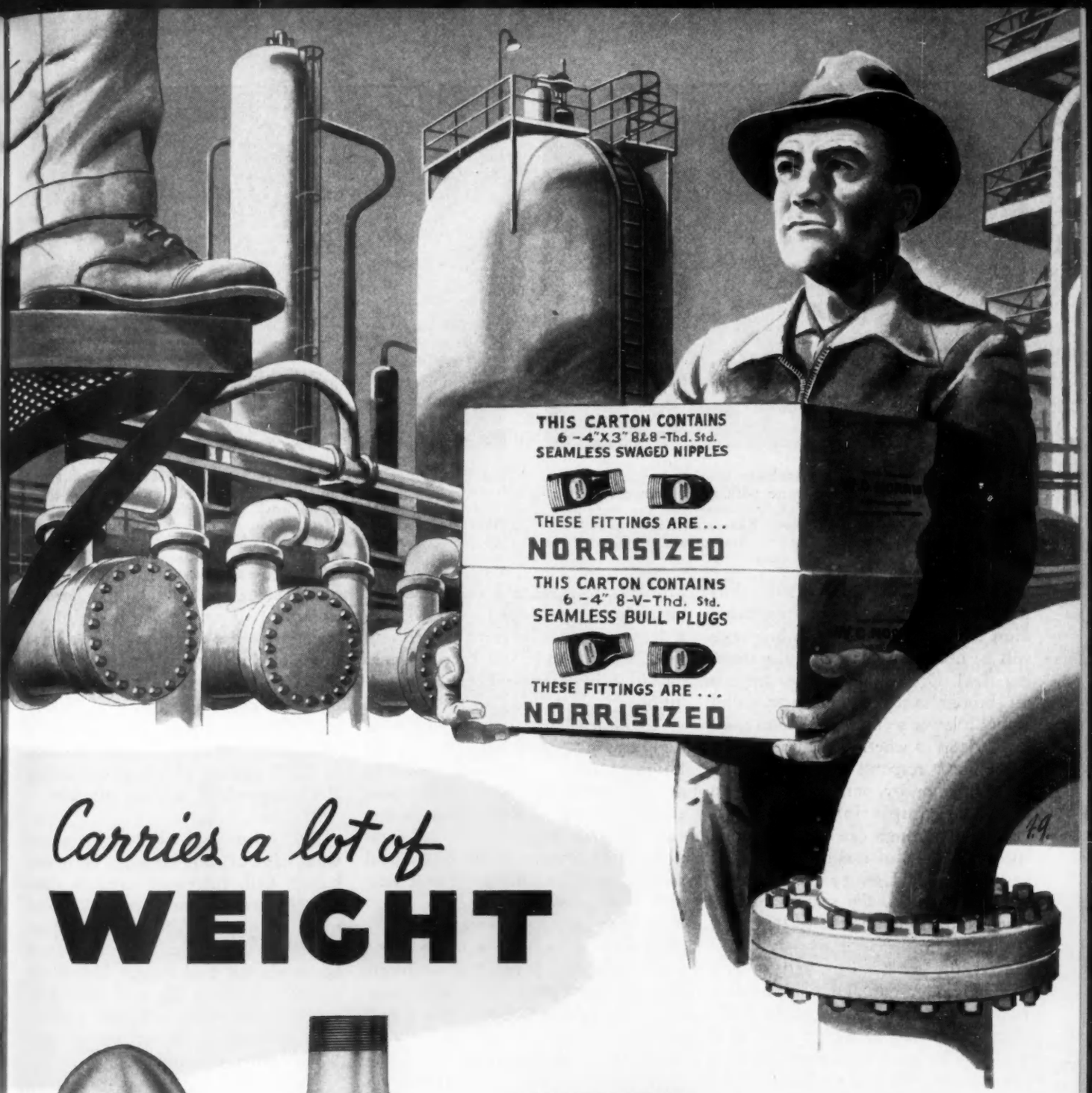
In an established reservoir, the acidizing techniques (type and quantity of acid, additives, and treating procedure) are usually well defined by experience with other wells in the area. In an undeveloped area however, careful attention must be given to the individual well's requirements, if optimum benefit is to be derived from the stimulation treatment.

As a wildcat well is being drilled and a zone of possible production encountered, accurate samples of the formation, extending as far as 100 feet above and below the expected pay, if drilled, should be made available to those persons responsible for the chemical treatment. These samples of adjacent zones will be helpful in case no production increase is obtained after chemical treatment. A correlation of returning fluid and formation samples often indicates whether the fluid entered the section desired, or entered a non-productive section above or below.

As the possible producing section is drilled, accurate records of type of drilling fluid, loss of drilling fluid, shut-down time, depths of sample cuts or cores, and mud pump pressures should be made. From drill stem tests, the data of bottom-hole pressure, bottom-hole temperature, and volume of fluid recovered, as well as samples of recovered fluid should be made available to treating engineers. With the above information, the choice of treating fluid can be made while continued drilling takes place, or while pipe is being set.

During the process of setting pipe, the important problem of obtaining a job without channels of contaminated cement must be kept in mind. Channeling is a major cause of failure in many acidizing treatments. Often when channeling must be repaired by squeezing, a permanent loss of production occurs. Where possible, a stage of mud-dissolving acid should be injected ahead of the cement, in order to obtain the proper bondage between the pipe and formation.

Depending upon the results of tests on formation samples and charting of recorded data, the choice of pipe to be set is also a related problem. Injec-



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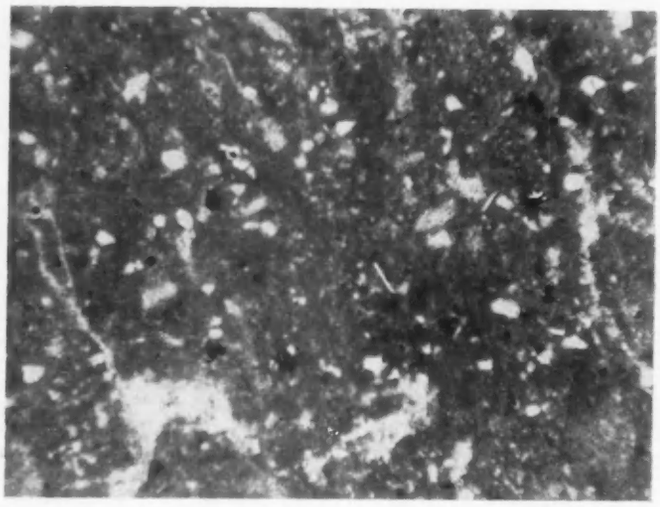

Fig. 2—Photomicrograph of core from Glorieta formation. Composed of microcrystalline dolomite with small stringers of dolomite in which the grains are slightly coarser than the main mass. The clear white grains are quartz. Elongated white crystals are muscovite. Black grains are pyrite. Intercrystalline porosity is very poor.

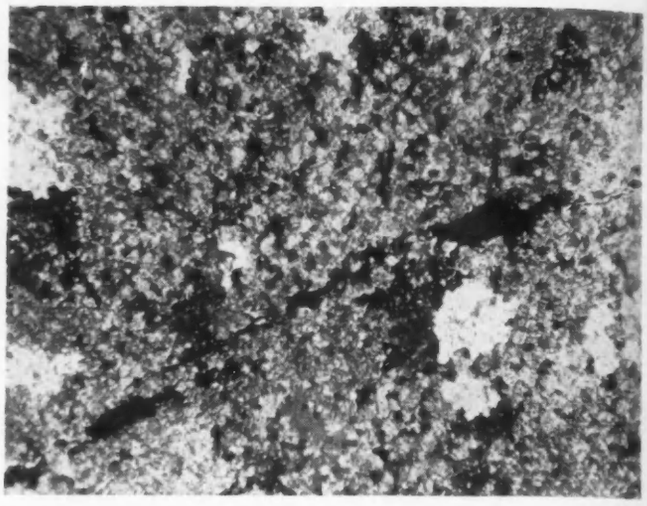

Fig. 3—Photomicrograph of core from Glorieta formation. Open fracture in anhydritic dolomite. A number of these narrow, short fractures are present in the rock. Anhydrite crystals are white. Dolomite grains range from microcrystalline to very fine. Intercrystalline porosity is poor to fair.

tion pressures to be encountered during subsequent stimulation treatments must be anticipated. Also, what steps will be necessary to recover the treating fluid. Often, if an upper zone is set through in order to make an initial test of a lower section, a decision must be made as to whether the upper zone would best respond if completed as open hole or by perforating. If an open-hole completion seems preferable, a set-through can be made using special sections of casing that can be easily removed later by chemicals.

With pipe set, the section opened chemically or by perforating, and often the heavy drilling equipment moved and replaced by lighter completing equipment, the final treating recommendations can be made. Sufficient knowledge of well conditions is available to serve as a guide in solving any problem that may arise as the acidizing treatment progresses. The treating engineer is now ready to plan the acidization, choosing the best treating materials and method of application.

Laboratory Testing. Starting with the four basic factors (formation samples, natural formation fluid samples, samples of the drilling mud being used, and various acid solutions and additives), a series of tests and examinations are made. Although some of these tests are made simultaneously they will be discussed separately.

• **Solubility tests.** In order for an acidizing treatment to be beneficial to an oil or gas bearing formation, the primary prerequisite must be that the formation be acid-soluble, or contain a foreign material such as drilling mud, which can be dissolved, at least partially, by a hydrochloric acid solution.

A weighed portion of the formation sample is placed in a 15 percent solution of hydrochloric acid and the amount of residue or insoluble portions measured. If the residue is less than 25 percent of the original sample, the 15 percent hydrochloric acid solution may be considered as a suitable treating agent.

When a larger percentage of insolubles appear, a test is made using a solution of 15 percent hydrochloric acid and an "intensifier," which enables the acid solution to react with additional parts of the sample, such as silt and clay. In the case of a dolomite sample, which dissolves but slowly in hydrochloric acid, this intensifier will also increase the reaction rate.

If the percentage of insolubles is still high, then a lower acid concentration may be desirable in order that more carrying medium, per volume of insolubles released will be available to wash them from the formation. These insolubles, when set free, often become lodged as they return to the well bore with the spent acid. As a result, they may completely offset, through blocking action, the increased drainage area created by the acid.

As a rule, it is not advisable to employ concentrations of hydrochloric acid above 15 percent, due to the difficulty of returning such spent acid solutions to the well bore following treatment. The calcium chloride formed by the reaction between hydrochloric acid and the formation is removed, dissolved in the spent acid. For example, 1000 gallons of 15 percent acid will dissolve approximately 10.8 cubic feet of limestone, resulting in 953.5 gallons of water containing 2042.4 pounds of calcium chloride.

Such spent acid solutions are somewhat viscous, the viscosity becoming higher with increased calcium chloride content. If acid concentrations of more than 15 percent are used for acidizing, the resulting spent acid will be so viscous and syrupy it will not return readily to the well bore and, especially in wells with low bottomhole pressure, may set up a water block in the formation.

• **X-Ray analysis and swelling test.** An X-ray examination is frequently made to determine the exact composition of the formation samples to detect rock constituents which, under well conditions, might act unfavorably to an acid treatment. If the X-ray indicates that portions of the sample contain particles, usually silicates, that tend to swell in the presence of water or acid solutions, then special tests are made with acids containing swelling control agents, to determine if the volume of insolubles can be minimized to a point where they will not interfere with subsequent production.

It is not uncommon for certain silicates to increase by swelling until

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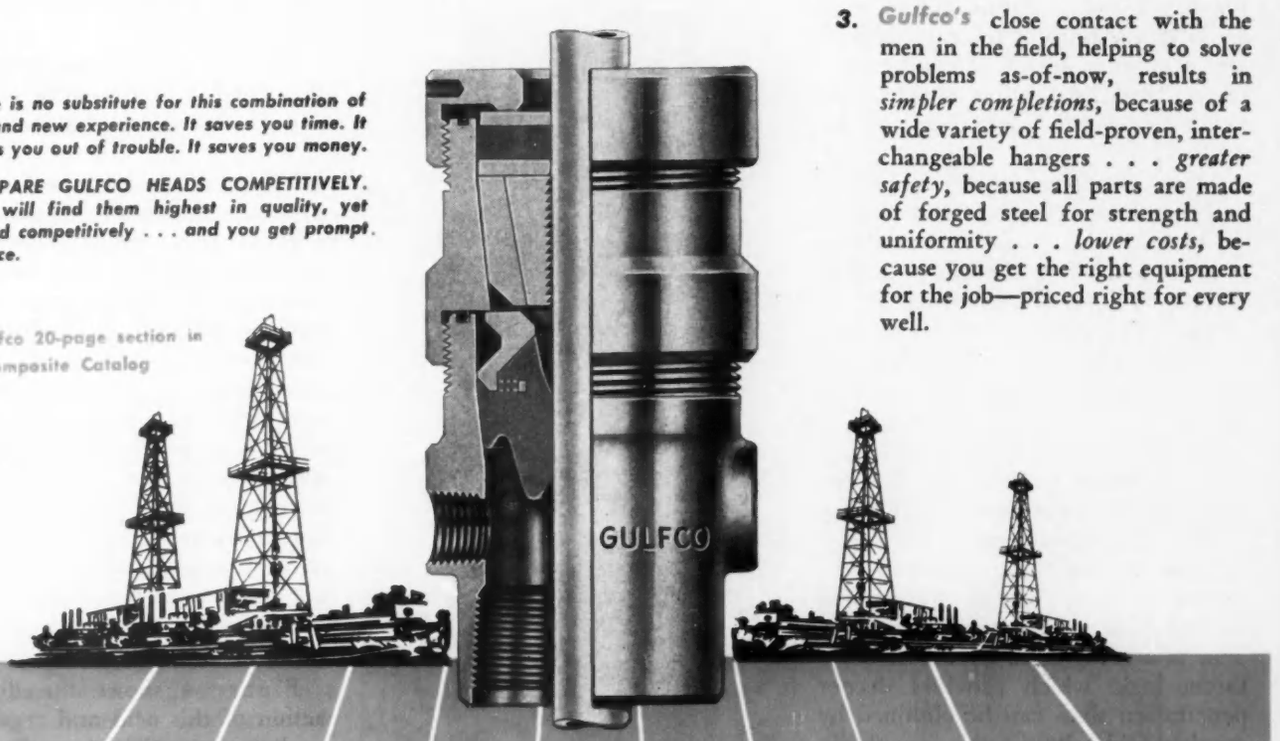

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they are from 100 to 200 percent larger than their normal size. In such cases, comparative swelling tests will indicate which of several control agents is most effective. As an example, Table 1 shows typical swelling test data, on core samples from the Glorieta formation, in the Prentice Pool, Terry County, Texas.

• **Core analysis and petrographic study.** Core sections are checked to determine percent porosity, permeability, fluid content and then photomicrographed for visual examination. Two typical samples are from the Glorieta (Permian) formation in Terry County, Texas, are shown in Figures 2 and 3. From studies such as these, the natural fracture pattern and crystalline structure can be analyzed. The distribution of insoluble materials in the rock also can be studied.

Many low permeability sections will require low surface tension acid, so as to avoid excessive breakdown pressure and allow the fluid to return more readily, thus preventing "water blocks." This property of low surface tension is achieved by the addition of agents commonly known as wetting agents.

If the studies reveal a series of fractures where drilling mud has encroached, then the chemical makeup of the treating fluid may be changed in order to give these fractures, containing relatively large sections of surface area, a thorough cleansing. This is accomplished by use of a retarded acid which provides deeper penetration than can be obtained by regular acid without the use of excessive volumes.

TABLE 1

Solubility and Swelling Test Data

Samples taken from a well in the Prentice Pool (Glorieta formation), Terry County, Texas.

DEPTH (in feet)	Percent Solubility	Percent Reduction in Swelling
5946 —5947.5	88	24
5947.5—5953.5	92	16
5953.5—5958	91	13
5958 —5962.5	90	17
5962.5—5964	93	25
5964 —5967	90	24
5967 —5970	90	20
5970 —5973	90	18
5973 —5976	86	0
5976 —5980.5	78	3
5980.5—5983.5	84	5
5983.5—5986.5	75	5
5986.5—5989.5	72	2
5989.5—5992.5	92	19
5992.5—5998.5	78	17
5998.5—6001.58	85	18
6001.5—6004.5	64	15
6004.5—6007.5	82	17
6007.5—6010.5	78	14
6010.5—6013.5	86	14
6013.5—6018	73	8
6018 —6018	71	10

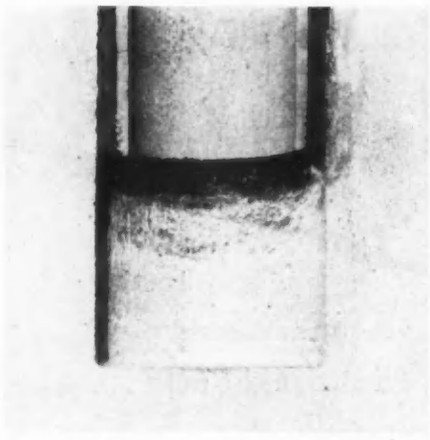


Fig. 4A—Cross-section of test block of homogeneous limestone.

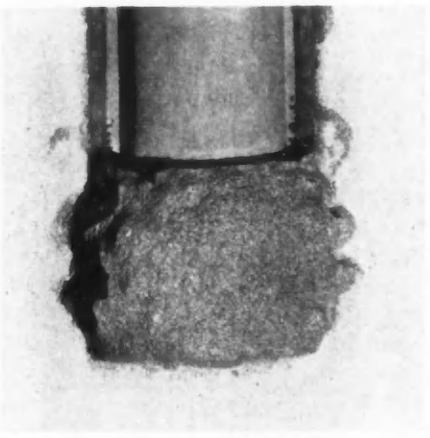


Fig. 4B—Cross-section of similar block after treatment with ordinary hydrochloric acid.

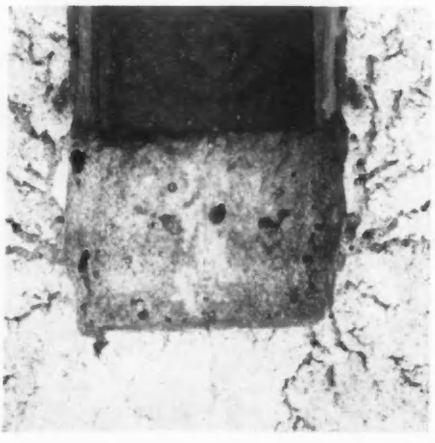


Fig. 4C—Cross-section of similar block after treatment with special channeling acid.

• **Emulsion tests.** Where possible, no unproven oil bearing reservoir should be acidized without first checking for possible emulsion difficulties. Emulsions formed between the spent acid and the formation crude oil may require long expensive treatment to return the well to production.

Emulsifying compounds occur naturally in many crude oils. Such chemical materials are partially insoluble in both oil and water. When two immiscible fluids (oil and water) are mixed closely, as they are when an oil bearing stratum is acidized, the emulsifying compounds tend to collect at the surface of contact between the oil and water and form a stable emulsion.

Emulsion tests will indicate if emulsifying agents are needed in the acid, to counteract the effect of these naturally occurring emulsifying compounds, allowing the oil and water to separate. Unlike acid inhibitors and wetting agents which are effective under any well condition, different emulsion-preventing agents may be required for different crude oils. Such emulsion tests will determine which demulsifying agent will be most effective in a specific well to be treated.

• **Special studies.** The use of increased volumes of acid normally results in larger production increases being secured, however there is an economic limit above which no further benefit can be derived. Often, this economic line can be extended through the use of smaller volumes of acid, which has been modified whereby it can penetrate deeper into a soluble formation before becoming completely spent. This type of acid allows itself only a limited reaction on each soluble surface which it contacts, and must move deeper into the formation to contact fresh surfaces before it can continue its reaction.

Figure 4 shows the differential action of this acid and regular acid, as demonstrated in controlled laboratory tests on identical limestone blocks. In many cases the use of a channeling acid has resulted in the connection of a well bore, opened in a low permeable location, with reservoir sections having ideal producing characteristics.

This is accomplished at a great saving in dollar value because the benefits derived from the acid treatment extending into the formation, whereas the bulk of a regular acid treatment is confined to a portion of the formation located relatively close to the well bore.

Treating procedures. Having determined the proper treating fluid, preparations are next made for its injection. The procedure employed may vary widely for different areas, de-

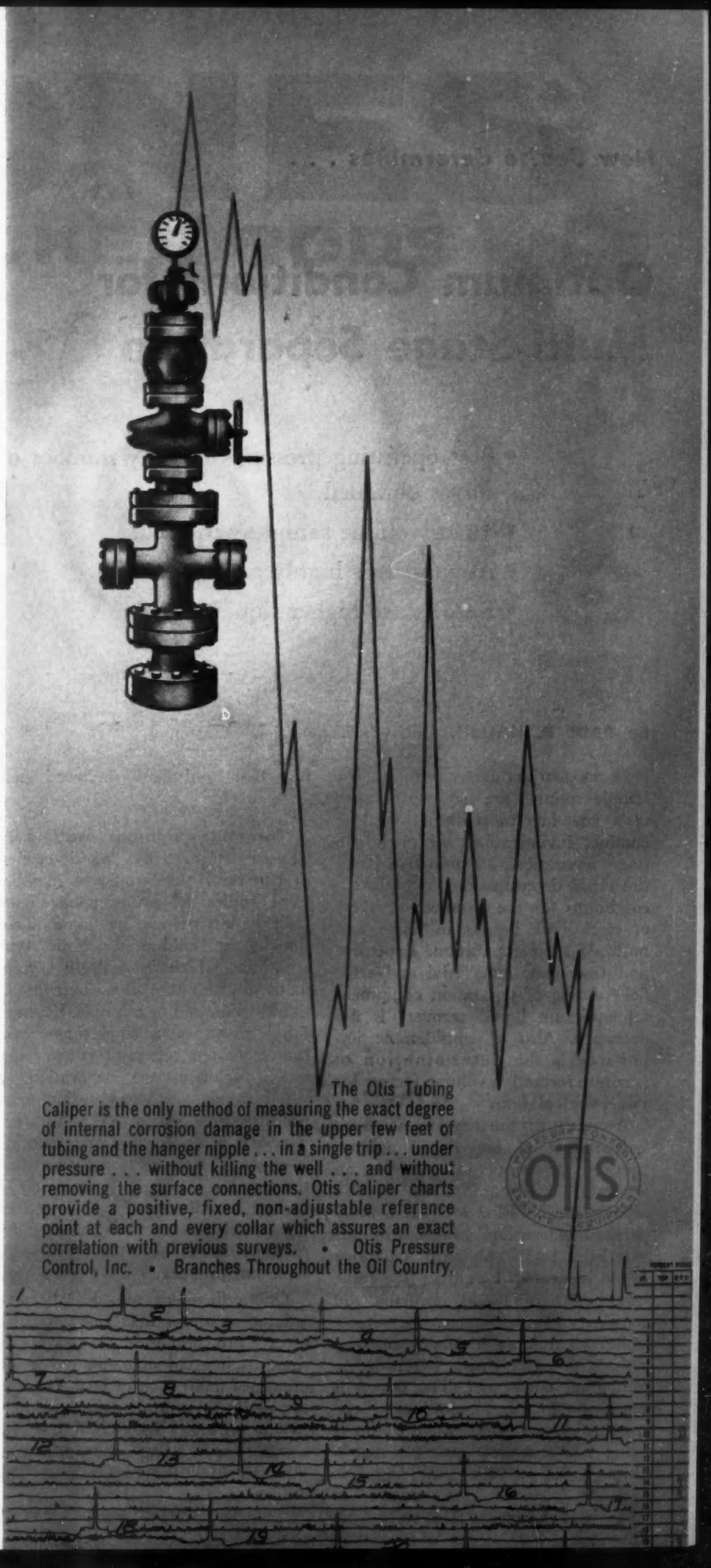
pending on the availability of treating tools and differences in operating practices. The following considerations, however, apply in practically all areas.

1. If high injection pressures are expected, a universal-type packer is placed in the casing below the top limit of cement protection. Injection takes place down the tubing. The return of the fluid is accomplished through the use of a tubing swab, allowing the annular space to remain filled with fluid. This method provides a quick way of determining results in a deep well, and also leaves the well in condition for squeeze plugging if necessary.
2. If low injection pressures are expected, but normal reservoir pressure is sufficient to allow the well to flow after treatment, then the treatment may be conducted without the use of a packer. In such cases, the well is swabbed in through the tubing and placed on production with the annulus dry.
3. If formation pressures are subnormal and injection pressures low, then either method 1 or 2 may be used, but generally the treating fluid will be injected down the casing and enough flushing medium used to displace the acid into the formation. Where pipe capacity of flushing fluid is not needed to displace acid, a float run on a steel line can be used to locate the top of fluid and to determine when the acid has been displaced. This method saves considerable time in recovering fluid, as well as reducing expense. If a gas supply is available, compressed gas can also be used to displace the acid with the aid of steel line and a float. After the acid has been displaced, the compressed gas is released quickly, allowing for a fast return of spent acid and insoluble particles. This method provides the best method of cleanup possible in low-pressure formations.

ACKNOWLEDGMENT

The authors wish to express their thanks to W. A. Waldschmidt, geologist and petrographer, for the petrographic photomicrographs included in this article.

—The End



New device determines . . .

Optimum Conditions for Multi-Stage Separation

- **Best operating pressures for any number of stages obtained.**
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- **Results are higher liquid recoveries.**

By PAUL P. KALISH, Gulf Oil Corporation, Houston

INCREASED ACCURACY with smaller sample volumes are but two features of a new laboratory device used to conduct investigations on multiple stage separation. Its primary use is the rapid determination of operating conditions for the optimum recovery of stock tank liquids in single and multiple stage separation. Expensive and time-consuming trial-and-error field testing of separation equipment for optimum liquid recovery is not necessary. Also of considerable importance is the determination of accurate formation volume factors for reserve calculations.

Accuracy of the new apparatus is independent of any liquid holdup, pressure or temperature effects on separator calibration, or of the separator calibration itself. It is independent of the liquid meniscus characteristics, or of volume of separator liquid measured. Less than five cubic centimeters of liquid normally are required for each stage. An almost unlimited number of stages are possible with extra stages requiring no additional equipment. The design is readily adaptable to multi-stage separation over a wide range of operating temperatures and pressures through the use of a small temperature bath and glass-windowed steel separator.

Former equipment used. Laboratory separators of diversified designs have been employed in separator studies. All, however, have been more or less refinements or modifications of the "calibrated volume" type separator, which is calibrated volumetrically for the measurement of liquid volumes. For example, the most simple form of a single-stage calibrated volume separator is the graduate. for two-stage separation, a vessel capable of withstanding some pressure is connected to the graduate. The first pressure stage of separation is effected in the pressure vessel and the resulting liquid subsequently is flashed into the graduate. The pressure vessel also may be calibrated for measurement of liquid volume at separator pressure.

One refinement of the calibrated volume separator may be referred to as a "precision-bore" instrument, since its internal diameter has a tolerance of 0.001 inch or less. Attempts are made to measure liquid volumes to the nearest 0.01 to 0.02 cubic centimeters by using a vernier in conjunction with the calibrations. This instrument frequently is employed as a multistage laboratory separator by using a partial differential vaporization process in all stages other than the first. Since the predominant process inside field separators is flash vaporization, laboratory data based on the differential process are unreliable.

Displacement type separator. Calibrated-volume separators in general have a number of inherent sources of error, most of which at best can only be minimized by operational technique. Experimental results are more or less accurate, depending upon the nature of the fluids under test as well as the quality of the equipment. To eliminate the objectional features of the calibrated-volume separator, a laboratory "displacement" type separator has been designed and is being patented by the author. Some of the advantages of the displacement separator as compared to calibrated-volume separators are listed below. These advantages will become evident as the apparatus and method of operation of the displacement separator are described.

1. Accuracy is completely independent of any liquid holdup.
2. Accuracy is independent of pressure and temperature effects on separator calibration.
3. Accuracy is independent of any separator calibration.
4. Accuracy is essentially independent of liquid meniscus characteristics.
5. Accurate volumetric measurements are independent of volume of separator liquid measured.
6. Less than five cubic centimeters of liquid normally is required for each stage; operation is on a semimicro basis possible.
7. Relatively unlimited number of stages are possible with extra stages requiring no additional equipment.
8. All stages are true flash vaporizations.
9. Design is readily adaptable to multistage separation over a wide range of operating temperatures and pressures through the use of a small temperature bath

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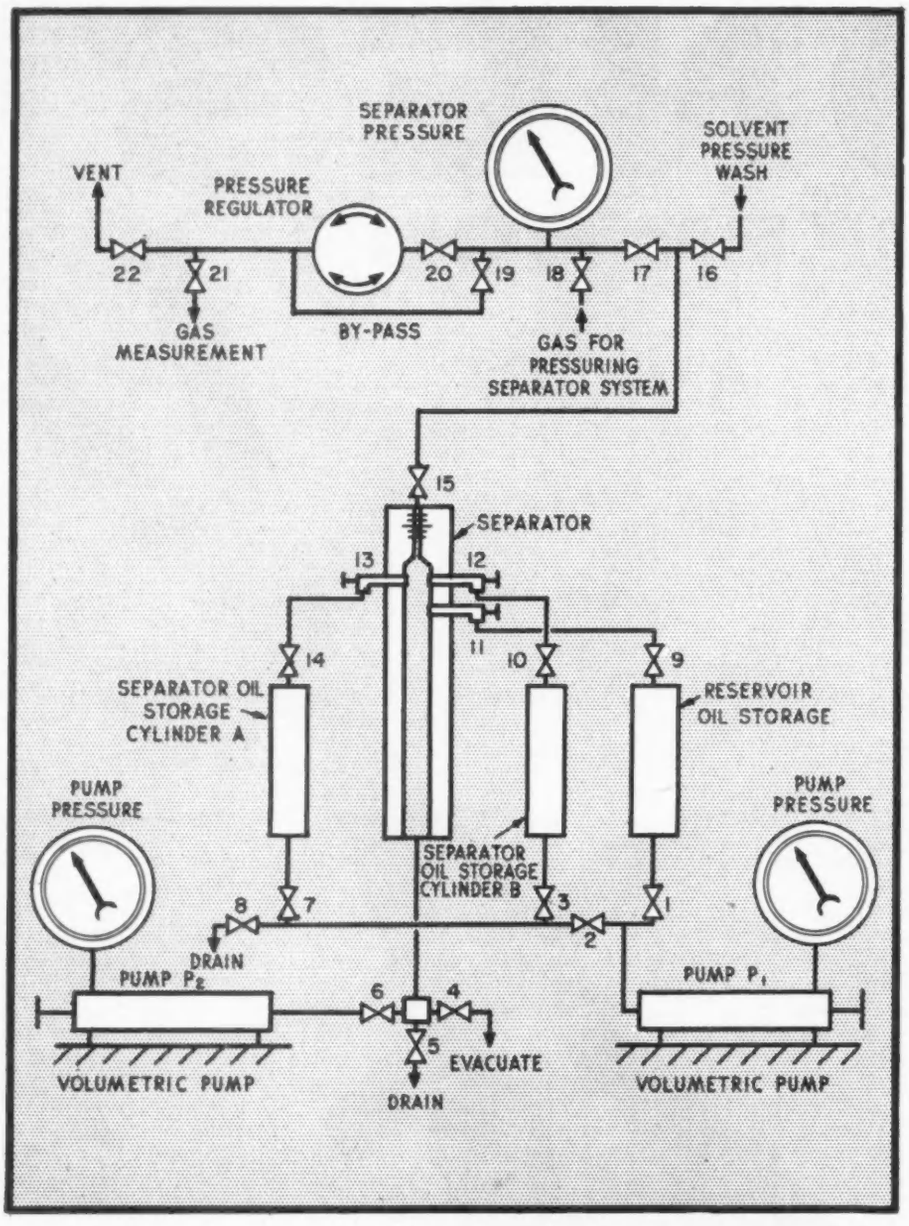

Fig. 1—Schematic representation of laboratory multistage displacement separator.

and glass-windowed steel separator.

The diagram in Figure 1 illustrates the main features of the multistage-displacement-separator employed in all the tests reported herein. The primary purpose of these tests was to establish the precision or reproducibility available with the separator and compare its results with those of a precision bore unit. Only the volumes of separator and stock tank liquids were measured during flash vaporizations; no attempt was made to measure the evolved gases as such measurements normally offer no problem.

The displacement separator employed was machined from transparent lucite rod, 2½ inches in diameter. The lucite unit provides working pressures of at least 600 pounds per square inch, exhibits good resistance to aliphatic hydrocarbons, and will not be affected materially by brief exposures to the small quantity of aromatics present in petroleum crudes. The main chamber of the separator has a volume of approximately 40 cubic centimeters. The fluid charging valves are situated so as to permit the convenient handling of as much as 35 cubic centimeters of separator liquid, this volume being somewhat dependent on the extent of foaming as fluid flashes in the separator. The charging valves are the only non-standard items of auxiliary equipment. They are constructed and located so as to prevent trapping any gas when the separator liquid level is raised to an index mark for measurement.

The volumetrically indexed section located above the main chamber of the separator is approximately 1½ inches long. Five index marks spaced at five millimeter intervals represent volume increments of 0.010 cubic centimeters, permitting estimation and reproduction of volume measurements to within 0.001 cubic centimeters.

Arrangement of volumetric pumps with respect to the separator and storage containers can be varied. If two pumps are not available, for example, a slight change in experimental procedure will permit the use of one pump. The method of displacing and measuring fluids may be changed and accuracy retained if all volume measurements are still differential measurements based on the displacement of mercury at a given pressure and temperature. Arrangement of storage cylinders and method of transferring separator oil to cylinders likewise may be altered. However, the array shown in Figure 1 and the procedure outlined are probably the most convenient.

Super-pressure volumetric pumps were employed for all liquid volume measurements. To determine their accuracy, pump piston diameters were carefully measured with a standardized micrometer caliper. The accuracy of both pistons was excellent, and neither piston exhibited a diameter variation greater than plus or minus 0.0001 inch.

Because all liquid volumes are determined by differential mercury measurements with the pumps, the limit of volumetric precision of the displacement separator corresponds to that of the pumps. Since the variation of pump piston diameters was negligible, all deviations in volume measurements must be attributed to experimental error. The separator, however, is subject only to experimental errors caused by fluctuating temperature or pressure; therefore, if perfect temperature and pressure control could be maintained the precision and accuracy of results should equal that of the pumps.

Experimental procedure. When flash vaporizations were conducted at pressures other than atmospheric, the

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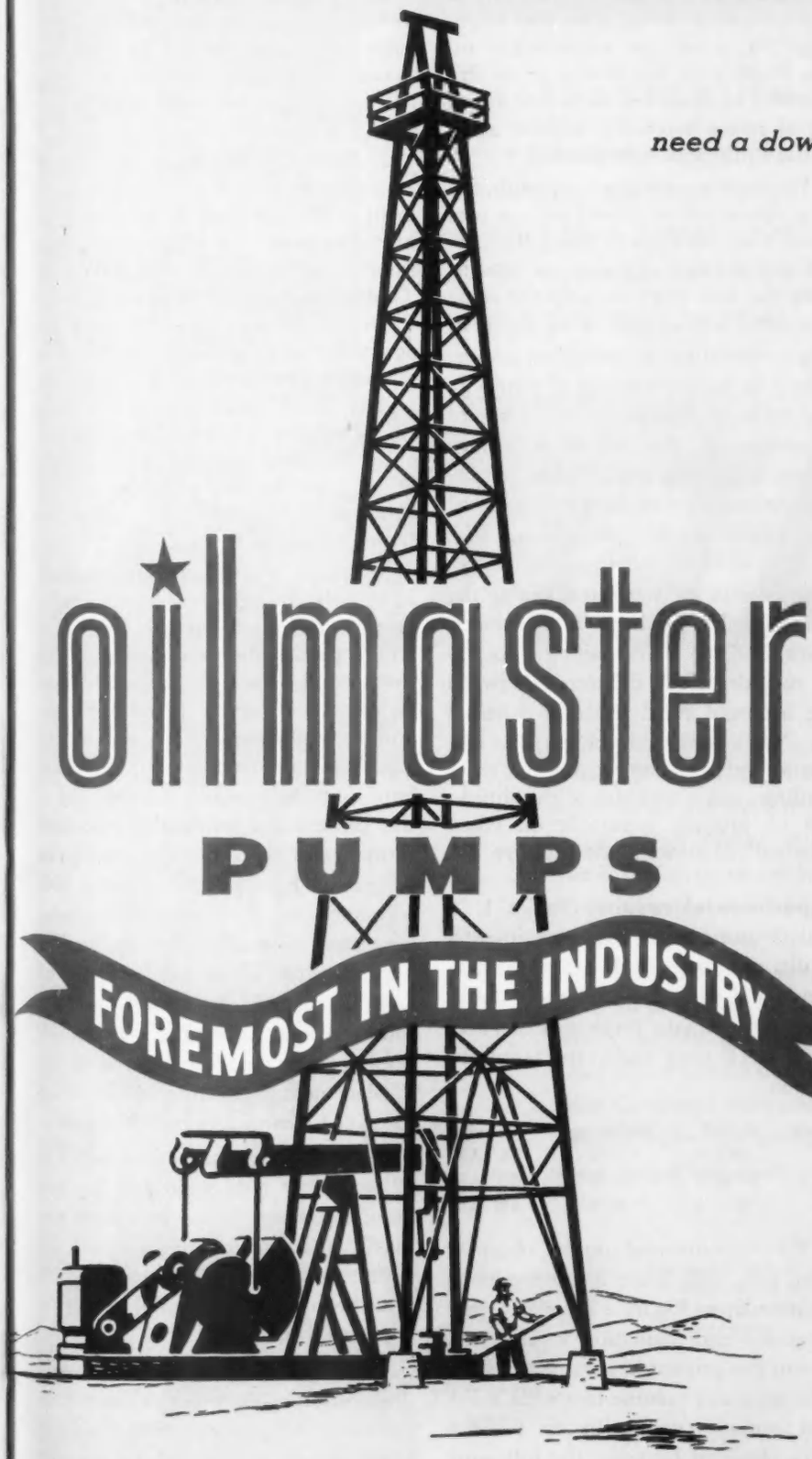

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The combination achieved some interesting results. With the top of the plunger protected from the high pressure fluid in the tubing, the pump couldn't pound fluid. The fluid load on the hollow polished rod did the necessary work of compressing the gas and transferring the fluid from the pump barrel to the annular chamber on the downstroke, and in addition it kept the rods in tension.

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separator system was pressured to and maintained at the desired pressure with a natural gas. Since only the precision of the apparatus was under study, effect of the natural gas on flash vaporization was not considered.

Referring to Figure 1, the separator system was pressured to and maintained at the primary separator pressure by use of natural gas, the back pressure regulator being adjusted in the process. Mercury was displaced with pump P_2 into the separator up to a reference index mark and the initial pump reading at separator pressure recorded. Mercury was then withdrawn with pump P_2 to a level which allowed sufficient space for accumulation of separator liquid. Subsequently, a measured quantity of reservoir fluid was displaced into the separator by pump P_1, while the back-pressure regular maintained constant pressure. When charging was completed, mercury was injected into the separator pump with pump P_2 until the separator oil level reached the reference index mark. The second reading of pump P_2 was recorded; the difference between the two readings at separator pressure was equivalent to the volume of first-stage separator liquid at separator conditions.

The first-stage separator oil was then displaced into storage cylinder A by injecting mercury into the separator with pump P_2. Prior to this transfer, cylinder A and the connecting line to valve number 13 were evacuated, filled and pressured with mercury. As the first-stage oil was displaced into cylinder A, mercury was withdrawn from the cylinder with pump P_1. With this transfer completed, the separator was cleaned and evacuated.

The atmospheric second-stage flash procedure was identical with that of the first stage except that pump P_1 was connected to cylinder A, and a measured quantity of first-stage oil was displaced from the cylinder into the separator. The difference between the initial and final readings of pump P_2 yielded the stock tank oil volume resulting from flashing an aliquot portion of the first-stage liquid to atmospheric pressure. Hence, all volume factors and interstage shrinkage were readily calculated from the experimental data.

Had a third stage been used, the second-stage oil would have been transferred to cylinder B and subsequently flashed back into the separator. If a fourth stage were required, cylinder A would have been washed and prepared to receive the third-stage oil, after the second-stage oil was transferred to cylinder B. In this manner, a relatively unlimited number of stages is possible without additional equipment or personnel.

To permit comparison with the type operation employed with a precision bore instrument using the partial differential vaporization process after the first stage, exactly the same procedure was employed for the first-stage separation as described above. After the second reading of pump P_2 was taken to determine the volume of first-stage oil, the second or atmospheric stage was simulated by lowering the mercury to the previous level and releasing the pressure on the system. Mercury subsequently was re-injected into the separator, raising the "stock tank" oil level to the index mark, and the third reading of pump P_2 recorded. The difference between the first and third readings equalled the "stock tank" oil volume; the difference between the second and third readings was a measure of the shrinkage of primary separator oil when "flashed" to atmospheric pressure.

Experimental results. Tables 1, 2, and 3 summarize the experimental results of a series of 43 separator tests conducted with three reservoir fluids. The approximate properties of each, on a stock tank basis, are tabulated below:

Fluid	G.O.R.	Shrinkage	Gravity
A	400/1	15%	35° API
B	4000/1	65%	50° API
C	500/1	20%	43° API

The experimental results obtained from tests with Fluid B are expressed graphically in Figure 2 by relating the separator and formation volume factors to the primary separator pressure. The separator volume factor (S.V.F.) and formation volume factor (F.V.F.) were obtained by using the following formulae:

$$\text{S.V.F.} = \frac{\text{Volume reservoir fluid charged to separator}}{\text{Volume separator liquid resulting at separator pressure.}}$$

$$\text{F.V.F.} = \frac{\text{Volume reservoir fluid charged to separator}}{\text{Volume stock tank liquid resulting at atmospheric pressure.}}$$

1. Fluid A was used in a series of 18 flash vaporization tests to determine the precision of the displacement separator. Results are summarized in Table 1. Average volumetric deviation was approximately 0.005 cubic centimeters or 0.1 percent, the maximum single deviation being 0.014 cubic centimeters or 0.3 percent.

2. Fluid B was used in a series of 13 separator tests, 9 with the displacement separator and 4 with a calibrated-volume precision bore separator. Results are summarized in Table 2 and expressed graphically in Figure 2. As with Fluid A, the average volumetric deviation in Fluid B separator measurements was approximately 0.005 cubic centimeters with the displacement separator. Apparently, the 0.005 cubic centimeter deviation is irreducible with the present equipment, regardless of volume of liquid measured.

Both type separators were operated in exactly the same manner, using a flash vaporization for the first stage and a partial differential process for the second. Since the results of the displacement separator were precise and were not subject to any of the experimental errors of the precision bore unit, these results can be used as the criteria for evaluating the performance of the other separator. The curves in Figure 2 illustrating performance of the calibrated-volume separator were obtained by lending approximately equal weight to the 65 and 115 pounds per square inch absolute points. When so constructed, these curves paralleled those of the displacement separator while being displaced some 6 per cent from them.

3. Fluid C was used in a series of 12 separator tests with the displacement separator. These tests were primarily intended to determine the difference between a flash vaporization and the partial differential process in the second stage.

The separator was operated under flash conditions at three primary-stage pressures. Duplicate flash and differential runs to atmospheric pressure

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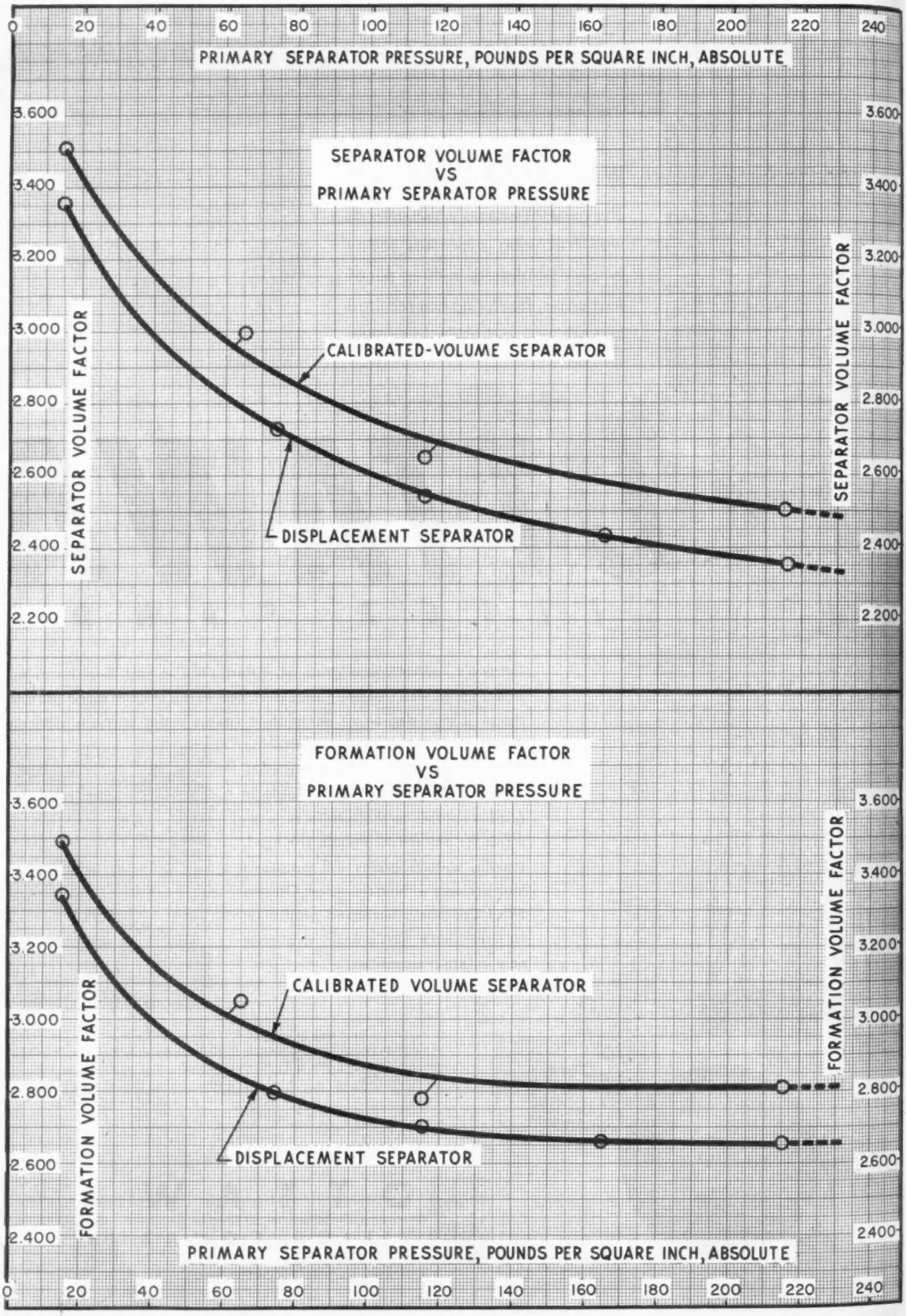

Fig. 2—Graphic comparison of results obtained by the displacement and calibrated-volume type separators. Fluid B was used to check separator and formation volume factors as a function of primary separator pressure. Tabulated results are shown in Table 2.

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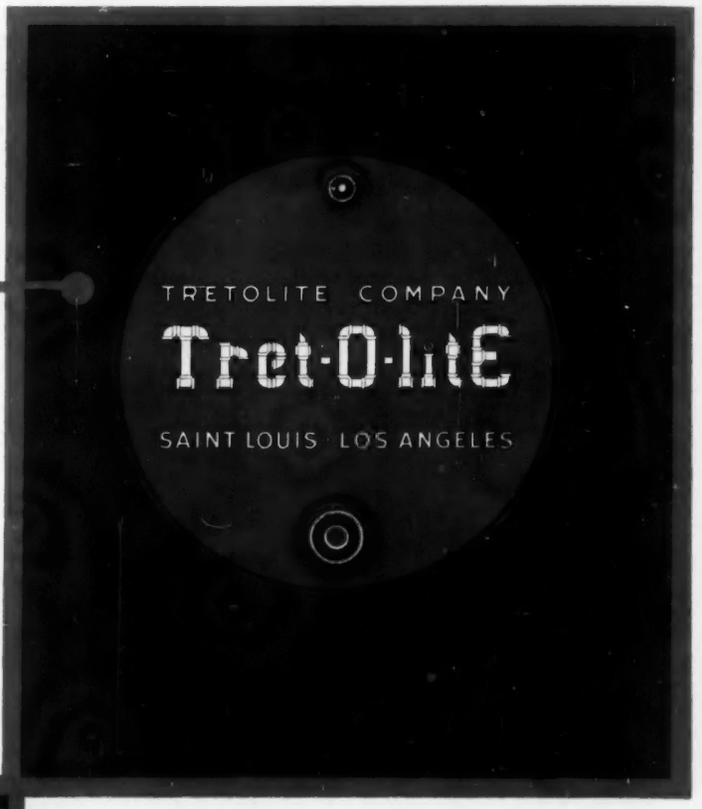

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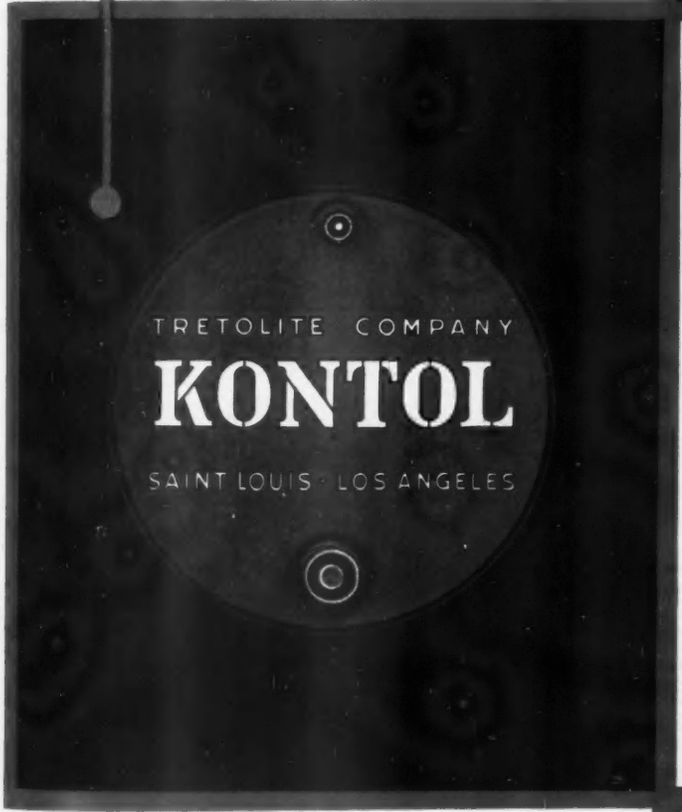

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were made with each primary separator oil so obtained, and the averages of the duplicate runs were compared. In order to magnify the differences between the flash and differential processes, comparison was made on the basis of average fluid shrinkage from the first stage pressure to atmospheric. The percent difference in shrinkage of the primary stage oil was calculated from the following relationship:

$$\text{Percent difference} = \frac{\text{Volume flash shrinkage} - \text{Volume differential shrinkage}}{\text{Volume flash shrinkage.}} \times 100.$$

A considerable difference between the flash and differential processes is apparent from the summary of results in Table 3.

Conclusions. On the basis of the experimental evidence accumulated, the following conclusions are justified:

1. Careful operation of the displacement separator will provide an average accuracy of at least 0.1 to 0.2 percent in flash vaporization experimental data when volume measurements are 5 cubic centimeters or more.

2. Under conditions of this test, accuracy of the calibrated-volume separator was significantly less than that of the displacement separator.

3. Results of a partial differential process are different from those of a flash process and cannot be relied upon for separator flash equilibrium data.

TABLE 1
Summary of Results—Fluid A
Flash Vaporization Tests With Displacement Separator

Run Number	Primary Separator Pressure (psia)	Volume Reservoir Fluid Flashed	Volume Separator Liquid	Percent Deviation	Separator Volume Factor
1	15	5.000 cc.	4.310 cc.	+0.2	1.160
2	15	5.000	4.303	+0.1	1.162
3	15	5.000	4.286	−0.3	1.167
Average	....	.....	4.300	....	1.163
4	55	5.000	4.326	−0.2	1.156
5	55	5.000	4.344	+0.2	1.151
6	55	5.000	4.343	+0.2	1.151
7	55	5.000	4.329	−0.1	1.155
8	55	5.000	4.327	−0.1	1.155
9	55	5.000	4.335	0.0	1.153
10	55	5.000	4.337	0.0	1.153
11	55	5.000	4.337	0.0	1.153
Average	....	.....	4.335	....	1.153
12	92	5.000	4.383	+0.1	1.141
13	92	5.000	4.382	0.0	1.141
14	92	5.000	4.377	−0.1	1.142
Average	....	.....	4.381	....	1.141
15	135	5.000	4.396	−0.1	1.137
16	135	5.000	4.403	+0.1	1.136
Average	....	.....	4.400	....	1.136
17	215	5.002	4.404	−0.3	1.136
18	215	5.002	4.427	+0.3	1.129
Average	....	.....	4.416	....	1.133

TABLE 2
Summary of Results—Fluid B
Comparison of Displacement and Calibrated-Volume Type Separators

Type Separator	Run Number	Primary Separator Pressure (psia)	Volume Reservoir Fluid Flashed	Volume 1st Stage Liquid	Percent Deviation	Separator Volume Factor	Volume Stock Tank Liquid	Percent Deviation	Formation Volume Factor
	1	15	2.000 cc.	....	....	3.361	0.595 cc.	−0.4	3.361
	2	15	2.000	....	....	3.333	0.600	+0.4	3.333
Average	..	....	....	....	....	4.344*	0.598	....	3.344*
	3	74	3.000	1.110	+0.5	2.703	1.077	+0.5	2.789
	4	74	3.000	1.098	−0.5	2.732	1.066	−0.5	2.814
Average	..	....	....	1.104	....	2.717*	1.072	....	2.799*
Displacement Separator	5	115	2.000	0.790	....	2.532*	0.739	....	2.706*
	6	165	3.000	1.242	+0.4	2.415	1.131	+0.4	2.653
	7	165	3.000	1.233	−0.4	2.433	1.123	−0.4	2.671
Average	..	....	....	1.238	....	2.423*	1.127	....	2.662*
	8	215	3.005	1.288	+0.4	2.333	1.133	+0.2	2.652
	9	215	3.005	1.278	−0.4	2.351	1.128	−0.2	2.664
Average	..	....	....	1.283	....	2.342*	1.130	....	2.659*
	10	15	24.86	....	....	3.492*	7.12	....	3.492*
Calibrated Volume Separator	11	65	23.25	7.79	....	2.985*	7.62	....	3.051*
	12	115	24.05	9.11	....	2.640*	8.65	....	2.780*
	13	215	20.00	8.02	....	2.494*	7.11	....	2.813*

* The Separator and Formation Volume Factors are expressed graphically as a function of primary separator pressure in Figure 2.

TABLE 3
Summary of Results—Fluid C
Comparison of Flash and Partial Differential Processes
Reservoir Fluid —▸ First Stage —▸ Atmospheric Pressure Stage

Run No.*	Volume Flashed (Fluid C)	Interstage Shrinkage	Difference in Interstage Shrinkage
1-F1	10.000 cc.	0.446 cc.	
1-F2	10.000	0.450	
Average	.....	0.448	31.3%†
1-D1	10.000	0.311	
1-D2	10.000	0.306	
Average	.....	0.308	
2-F1	10.000	0.351	
2-F2	10.000	0.343	
Average	.....	0.347	24.2%†
2-D1	10.000	0.266	
2-D2	10.000	0.260	
Average	.....	0.263	
3-F1	10.000	0.292	
3-F2	10.000	0.284	
Average	.....	0.288	19.4%†
3-D1	10.000	0.231	
3-D2	10.000	0.234	
Average	.....	0.232	

* F indicates a second-stage flash; D indicates a second-stage partial differential process.
† Based on average flash process.

ACKNOWLEDGMENT

The author wishes to express his appreciation to the Management of Gulf Oil Corporation, Houston Production Division, for permission to prepare and publish this paper. Appreciation is also expressed for the contribution of technical advice and materials by Ruska Instrument Corporation, Houston.

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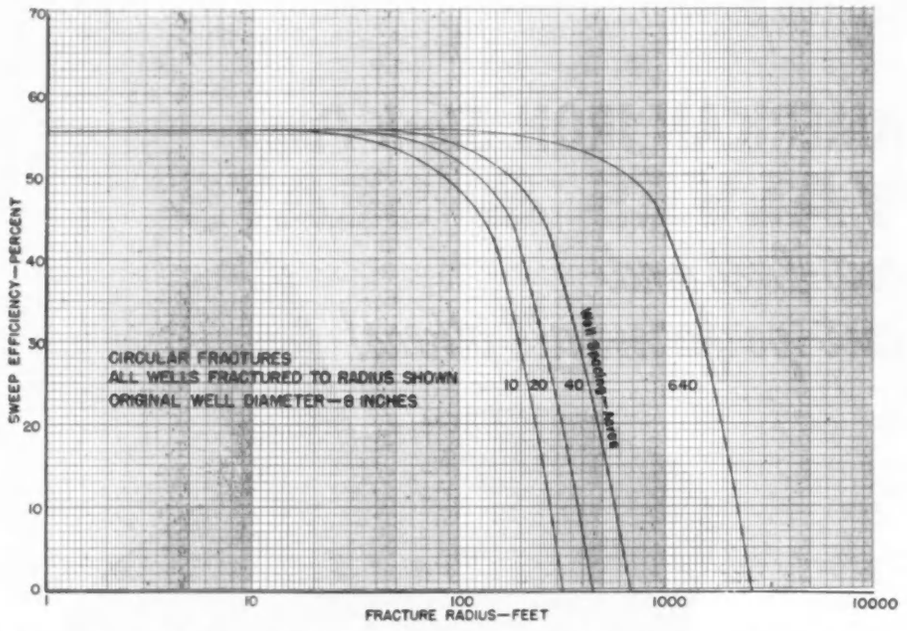

Fig. 1—Sweep efficiencies for the direct line drive (square) pattern in horizontally fractured thin reservoirs.

Part 5: Sweep Efficiencies of the line-drive pattern.

Water-flooding and gas cycling affected by . . .

Horizontal Fractures In Thin Reservoirs

By DR. PAUL B. CRAWFORD, Texas Petroleum Research Committee, College Station, Texas

THEORETICAL WATER-FLOODING and gas cycling sweep efficiencies of unfractured line drive patterns are fairly well understood for certain idealized flow conditions. Widespread application of reservoir fracturing techniques has resulted in a need for expanding the theoretical work to include the expected results after fracturing.

One type of fracture which is believed to be created in certain instances is the "pancake" fracture. In making the study which is shown here, the "pancake" fracture was considered to be an exact circle surrounding each well in the reservoir. Sweep efficiencies of such an idealized condition may be calculated provided the radii of the fractures are not too great.

The problem. Early work on the sweep efficiency of the unfractured direct line drive pattern was presented by Muskat and Wyckoff.[1] Their work showed how the sweep efficiency may be calculated by analytical procedures and indicated that the sweep efficiency for the unfractured case may be expected to be near 55.9 percent of the total pattern area.

In studying fractured pattern systems horizontal fractures were simulated in a potentiometric model by the use of thin copper disks soldered to the well or wells in the reservoir. Isopotentials from the periphery of one fracture to that of the other were of the same shape after lowering the fracture in place as they were with just the wire electrodes in position. This is to be expected, inasmuch as the circular fractures, being of very great conductivity, constitute an isopotential in themselves. Effect of the fracture was such that the pressure gradients within the volume of fluid above or below the horizontal fracture were of such low magnitude that it appears doubtful that any substantial amount of this fluid will be produced at the output well in any economic period of time.

After verifying that the sweep efficiencies for the case of horizontal fractures would be approximately equal to the sweep efficiency for the unfractured case minus the percent area of the circular horizontal fractures in the pattern, considerable effort has been made to show that certain portions of the data obtained for unfractured systems may be applied for the case of circular horizontal fractures.

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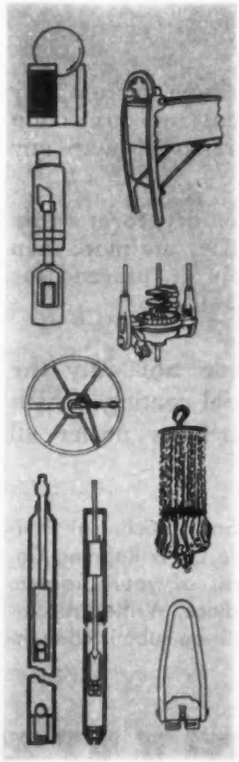

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tured thin reservoirs for the direct line drive pattern are shown in Figure 1. The sweep efficiency represents that percent of the pattern area which is swept out when the injected fluid first reaches the output well. Data apply for thin reservoirs with a mobility ratio of one, and for steady state conditions.

Under steady state conditions, the rate of fluid produced is equal to the rate of fluid injected. This is perhaps closest simulated for the case of gas cycling. In water-flooding, if the mobility ratio is other than one, other methods should be resorted to. It will be noted on the figure that a sweep efficiency of near 55.9 percent is to be expected if no fractures occur for either the 10, 20, 40 or 640-acre spacings.

If each well in a ten-acre spacing is fractured to a 30-foot radius, it will be noted that a sweep efficiency of near 55 percent may be expected. For 50-foot fractures, a sweep efficiency near 53 percent may be expected. When the fracture radius is equal to 150 feet, a sweep efficiency near 44 percent has been calculated. It will be noted that for fractures greater than 150 feet, sweep efficiency declines very rapidly as the radius of the fracture increases. The sweep efficiency will approach zero as the fracture radii approach 330 feet. Interconnections will occur and channeling from the input to the output wells is to be expected.

For 20-acre spacing, it will be noted that fractures up to 85 feet will result in sweep efficiencies of approximately 53 percent. Fractures of approximately 180 feet will produce sweep efficiencies near 44 percent. If the fracture radii equal 470 feet interconnections will occur, and the sweep efficiency will approach zero.

For the 40-acre spacing, a fracture of 120 feet will result in a sweep efficiency near 53 percent. A fracture of 260 feet will produce a sweep efficiency near 44 percent. It will be noted that the 40-acre spacing, as well as the others shown here, indicate that after a sweep efficiency of near 44 percent has been achieved a very rapid decline in sweep efficiency

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To thoroughly understand just how the Martin Plunger goes about whipping this problem of pumping wells with sand conditions, consider how the Martin Plunger works.

Numerous split rubber and duck rings, held in individually machined grooves, form a sand resistant seal without a tight, wearing fit in the working barrel. Rubber and duck rings withstand sand abrasion better than any metal or hard material.

In actual operation, the Martin Plunger produces a buffing and polishing action. It does not score or scratch the working barrel. The perfect, trouble-free combination, is the Martin Plunger and the Martin Rubber Guide Cage. Ask your supply house for the facts — facts which prove the superiority of Martin Plungers.

★ *Split Rubber and Duck Rings resist Sand Abrasion.*

★ *Only the Resilient Rings Touch the Barrel.*

★ *Gives Longer Runs . . . Lasts for Years . . . Less Pulling Costs.*

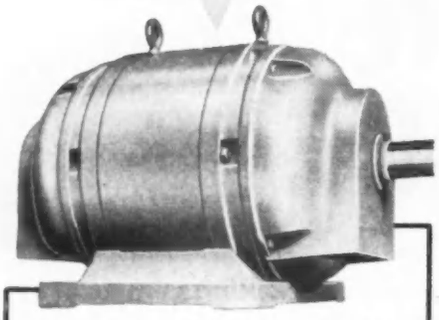
JOHN N. MARTIN
Manufacturer
9 W. BRADY STREET • TULSA, OKLA.

5 REASONS WHY

LEASE after LEASE PUMPS with

FIELDMASTER

BALL BEARING MOTORS



In the field you can depend on FIELDMASTER Ball Bearing Motors because they're specially built to meet the exacting demands of oil country use. Below are just five of the many outstanding advantages that make FIELDMASTER Ball Bearing Motors unsurpassed in their field!

1. Vermin Proof!

No matter how small, rodents and other animals can't get inside a FIELDMASTER Motor.

2. Drip Proof!

Special splash proof construction prevents damage to the motor from liquids and flying particles.

3. Moisture Proof!

Motor windings are specially treated for outdoor service... conduit box is moisture proof and dust tight.

4. Corrosion Resistant!

Weather-protected FIELDMASTER Motors can be used in any kind of weather — rain, snow, sleet, blowing sand and dust.

5. Forced Air Cooled!

This exclusive fan-cooling system provides cooler operation over longer periods of time.

May we ask our distributor, BETHLEHEM SUPPLY COMPANY, to contact you?

VALLEY ELECTRIC CORP.

4221 FOREST PARK BLVD., ST. LOUIS, MO.

occurs as the fracture radius is increased.

For 640-acre spacing a fracture of 400 feet radius is expected to result in a sweep efficiency near 53 percent. A fracture of 950 feet is expected to produce a sweep efficiency near 44 percent. Interconnections are expected to occur when the fracture radius approaches 2640 feet, in which case the sweep efficiency would be near zero.

In reviewing the above, it will be noted that sweep efficiencies between 53 and 56 percent may be achieved in the 10, 20, 40 and 640-acre spacings if the fracture radii are 50, 85, 120 and 400 feet, respectively. Other data which are not shown here indicate that the conductivities of these systems when fractured to these radii will result in approximately four fold increases in the conductivity of the pattern. Consequently, the flooding or cycling program may be completed in a much shorter time than could be achieved if no fractures occurred. Considerable quantities of the desired fluid may be obtained after breakthrough. By the injection of more fluid, the swept areas for the fractured system may be made to approach that for the unfractured case, provided the radius of the fracture is within the limits cited above.

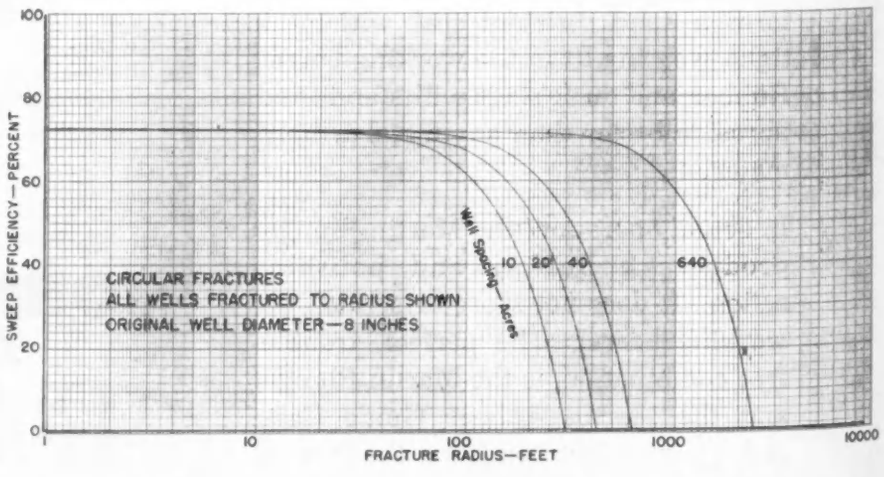
Conclusions. Studies have been made of the pattern sweep efficiencies of horizontally fractured thin reservoirs. Fractures were considered to be circular and to originate at the well. Conclusions which are drawn are restricted to the case of thin reservoirs operating under steady state conditions at a mobility ratio of one. Under such conditions it is shown that if the fracture radii exceed 150, 180, 260 or 950 feet for the 10, 20, 40 and 640-acre spacings, respectively, that some element of risk may be involved. In the event fracture interconnections occur sweep efficiencies of near zero may be expected.

The four fracture radii described above for the four well spacings are all expected to result in a sweep efficiency at breakthrough of 44 percent. Oil or gas is expected to be recovered after breakthrough. Consequently, swept areas in excess of 44 percent may be expected at abandonment for certain cases. It is also brought out that even short fractures, that is, 50, 85, 120 and 400-foot radius will result in sweep efficiencies of approximately three percent of that which is to be expected if no fractures occur for the 10, 20, 40 and 640-acre spacings, respectively. Fractures of the above length are expected to increase the pattern conductivity by a factor near four. This implies that the flooding or cycling program may be completed in a much shorter time after fracturing occurs.

REFERENCE

[1] Muskat, M., and Wyckoff, R. D., "A Theoretical Analysis of Water Flooding Networks," AIME Trans., Vol. 107,. P. 62 (1934).

To Be Continued

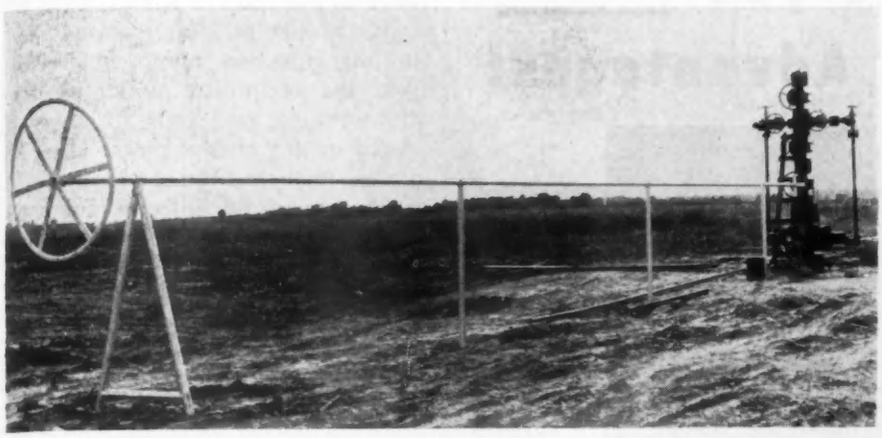


THE ABOVE CHART showing sweep efficiency of the five-spot pattern in horizontally-fractured thin reservoirs should have appeared as Figure 1 in Part 4 of this series, Page 197, December, 1954, WORLD OIL. The chart which appeared was in error and was intended to appear with a coming installment in this series.

How to do it

PRODUCTION HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas



Valve Stem Extended for Safe Shutoff

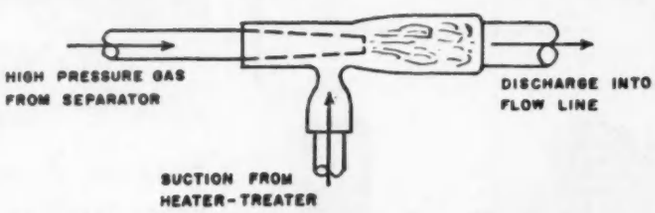
The valve stem and wheel of the master control valve on this well have been extended nearly a hundred feet to provide a means of closing in the well in case of emergency. Not only is increased leverage built into the extended stem and large oversized wheel, but the extension eliminates getting close to the well to shut it in.

The extension is of two-inch pipe supported at intermediate points by simple upright standards topped with an oversized coupling which serves as a bearing. The supporting members are set in concrete. The end support is an A-frame which also contains a similar coupling at the apex for support of the two-inch stem extension. The wheel is merely a six-spoked device made of 1½-inch pipe and strap steel. The outside diameter is about three feet.

The extension is connected to the master valve stem and handle by means of a cross-piece welded to the end of the extension. U-bolts fasten the four spokes of the valve wheel to the cross piece. Added safety and ease of operation are the result of this simple yet effective addition.

Simple Ejector Boosts Vapor Gas Pressure

A simple gas ejector in the high-pressure gas line as shown was used effectively to suck gas vapor from the heater-treater thereby eliminating a source of gas waste. The problem in this case was to utilize previously wasted heater-treater gas vapors so that they could be carried in the separator flow line into the natural gasoline plant. Since the separator gas flow line pressure was considerably higher than that existing on the heater-treater, it was a problem of boosting the vapor gas to that of the separator gas pressure.



The gas ejector shown in schematic form was installed, and it worked. Suction of the ejector was connected to the heater-treater vent line and gas from the separator flow line supplied the needed gas to provide the jetting action. In this manner, what formerly was wasted vent gas was carried into the separator gas stream to be processed for liquified petroleum. Although the gas ejector idea has been used in other industries, and was recently introduced into pipe line operations, this is considered the first time the idea has been tried successfully on a field problem.

A special hook or eyelet is welded into the top of the traveling block. A special hook on the wire line hooks into the eyelet, thus suspending the block a few feet from the floor. In this way it is possible to keep from laying the blocks down on the floor when slipping and cutting wire line. This results in a saving of several hours during the well.

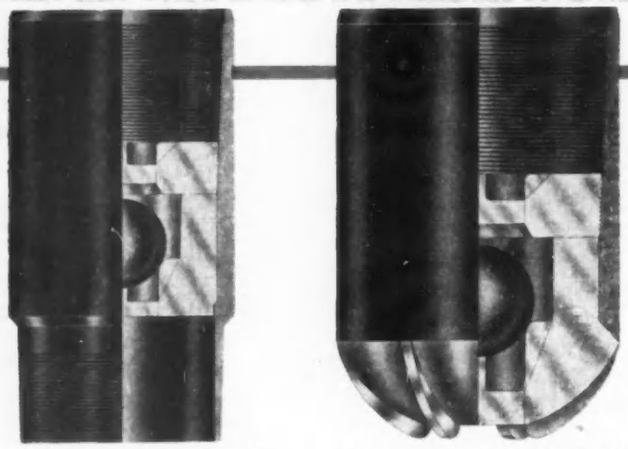
Localizing Injection Units Facilitates Servicing

Throughout the oil fields, the pumper's ingenuity has saved him many steps and valuable time. Here is another of those many instances where an idea saved time and money.

The installation is in an old field

RECTOR

ALL METAL Casing Shoes and Collars give you THREE Important NEW Advantages!



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1. GREATER STRENGTH: Aluminum alloy internal parts have far greater impact, compression, tensile and shear strength than cement or bakelite.

2. PRECISION CEMENTING: Being all metal, they can be precision machined and ground to close tolerances for precision performance.

3. RAPID DRILLABILITY: Because of its superior strength, less aluminum alloy is required. It not only drills out faster but there is less material to drill out.

• These new Rector Type "A" cementing shoes and collars have internal parts of a special aluminum alloy that combines strength, abrasion resistance and drillability. The bodies are precision machined from high quality seamless steel—internal aluminum alloy parts are machined and ground to close tolerances.

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REPRESENTATIVES IN ALL ACTIVE FIELDS

RECTORHEAD RECTOR CEMENTING METHOD RECTORSEAL

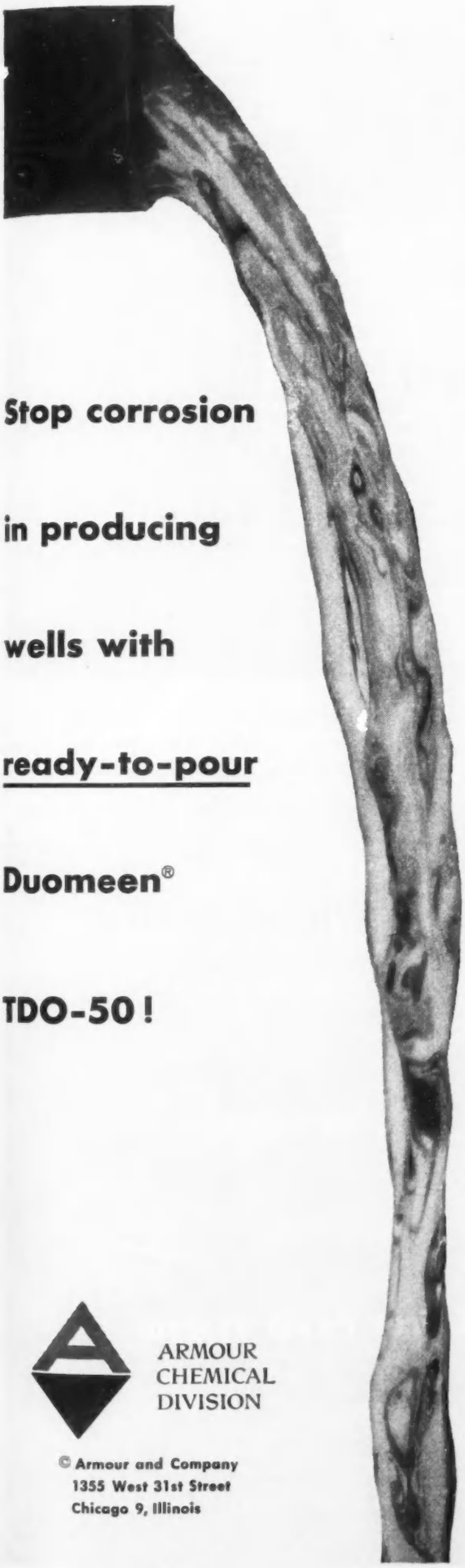
HINTS . . .

where central power is still in use. From 10 to 12 wells are pumped with each central power unit. By localizing the chemical injection units which injected emulsifying agents into the flow line at convenient points through the lease, the pumper can service these units quickly.

The unit shown above is located near a main lease road and the pumper can observe it each time he passes in the pick-up truck. Power for the injection pump is derived from the reciprocal motion of the above-ground pull rods which converged on the central power units. A quarter-inch steel rod is bolted to the crank arm of the injector pump to extend this arm up to the pull rod located directly above it. End of the quarter-inch rod is fitted inside a U-bolt which containes only the two nuts. This U-bolt is attached to the pull rod by means of a wire rope clamp as shown. As the pull rod moves back and forth, the power arm on the injector pump crank rocks to and fro. In case the pull rod breaks, this smaller crank extension rod will merely slip out of the U-bolt. This installation has been a simple and cheap way of motivating the injector pumps, and making it possible to place the injector units at the most convenient location on the lease.

Seal for Anodes Made From Ice Cream Cartons

An ordinary quart size ice cream carton makes an excellent form for pouring the hot tar, asphalt or pitch seal that goes at the top of graphite anodes to protect the electric cable



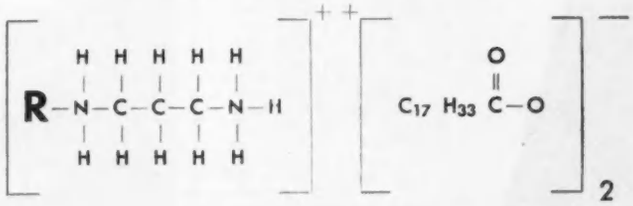
Stop corrosion in producing wells with ready-to-pour Duomeen® TDO-50!

No mixing! Just pour this low-cost Armour chemical down the hole—protects sucker rods, pumps, tubing!

Duomeen TDO-50 is our potent new corrosion inhibitor supplied as a 50% active solution. This cationic surface active agent is already mixed with a petroleum diluent to save you the trouble of blending in the field. It's ready to pour at even −10°F., ready to convert steel surfaces from water-wettable to oil wettable, thus forming a protective coating against corrosion.

Regular Duomeen TDO, our *100%* active corrosion inhibitor, has found wide use because of its outstanding results in controlling acid conditions in sour wells using quantities as low as 1-4 pints per 100 barrels of produced oil! But, since some of our customers wanted a ready-to-use form of this effective chemical, we developed ready-to-pour Duomeen TDO-50. Now, both products are available in truckload and drum quantities, to help you stop corrosion all the way down to the bottom of the hole. Send the coupon for our free technical bulletin on corrosion, and free samples of Duomeen TDO and TDO-50 to test yourself!

Structural Formula for Duomeen TDO:



Mail This Coupon to Stop Corrosion Costs Now!

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Please send me:

- ☐ Sample of Duomeen TDO
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01

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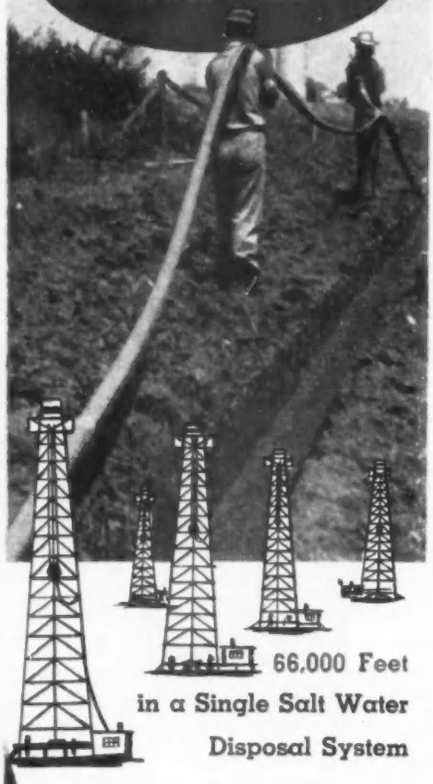

66,000 Feet in a Single Salt Water Disposal System

This system for salt water disposal at Heidelberg, Miss., is reported to be the largest installation of its kind in the U. S. . . . sizes up to 6" laid at the rate of a mile a day. Southwestern's Kralastic* Pipe was chosen for its higher quality, lower cost, ease of installation and "Built-In" corrosion resistance. If corrosion or parafin build-up is your problem, Southwestern manufactures a plastic pipe to meet your needs. Call your Southwestern representative or write direct to factory. Kralastic, Tenite, PVC and Polyethylene Plastic Pipe is guaranteed by Southwestern which is backed by one of the nation's leading pipe manufacturers, Texas Vitrified Pipe Co.

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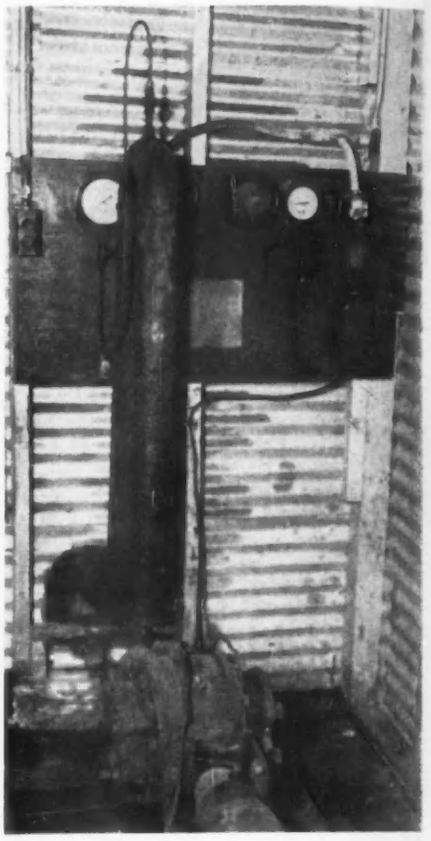
HINTS . . .

connection. As shown in the illustration, the five-foot-long anodes are placed upright in a shallow hole, then the seal is heated over the portable burner shown in the foreground. The lid of the carton is discarded and the cable is threaded through a small hole in the bottom. The carton is then snugged over the anode, and a hole is cut in the inverted bottom, so the seal material can be poured.

Salt Water Pump Is Controlled Automatically

Salt water taken from several gun barrel tanks is moved to one central treating station by an electrically-driven centrifugal pump. In order to free the pumper during the time the centrifugal pump is moving salt water, automatic electrical controls are incorporated at the pump house. These include both a high-pressure and a low-pressure mercury switch. The low-pressure (or vacuum) switch is located on the suction side of the pump, while the high-pressure mercury switch is on the discharge side.



Purpose of the vacuum switch is to stop the electric motor when the water level in the gun barrels has reached a predetermined low level

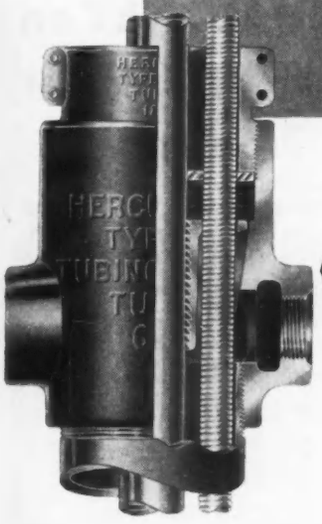
The most flexible, least expensive method of pumping oil wells is the KOBE *Free Pump System*

KOBE INC. HUNTINGTON PARK, CALIFORNIA

IN MEDIUM DEPTH WELLS

HERCULES "TYPE J-5-R" AND "RC" TUBING HEADS

DESIGNED FOR USE WITH REDA PUMPS



Designed for medium depth wells. Will suspend 5000 feet of 2" or 2½" Tubing or a proportionate amount of 3". Available in casing sizes from 5½" OD (which will suspend 2" or 2½" tubing only) to 7" OD which will suspend 2", 2½" or 3" tubing. Pressure cast steel body hydrostatically tested to over 4000 psi. 2" LP outlets furnished. (3" optional). Approximate over-all height, 14½".

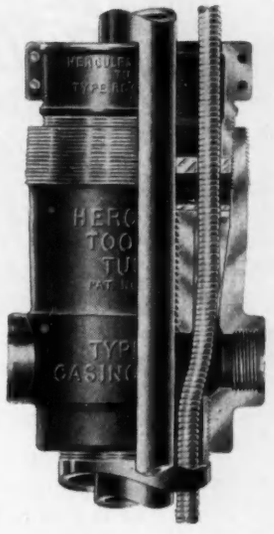
Both heads feature the positive aligning hinged slips (which allow the electric cable to pass through the slips close to the tubing) and the overhead packing arrangement which packs off the tubing and electric cable simultaneously. The packing arrangement in both heads is tested to 2000 psi.

"TYPE J-5-R" TUBING HEAD

SOLD AT ALL SUPPLY STORES

Built to support the weight of 10,000 feet of 2", 2½" or 3" Tubing, 5,000 feet of 4", or 4,500 feet of 5½" Casing. Available in casing sizes from 6⅝" to 9⅝" OD. 3" side outlets furnished. Pressure cast steel body tested to 4000 psi. Approximate over-all height, 23".

IN DEEP WELLS



"TYPE RC" TUBING HEAD

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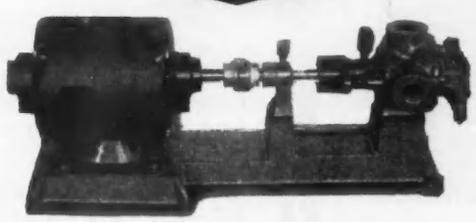

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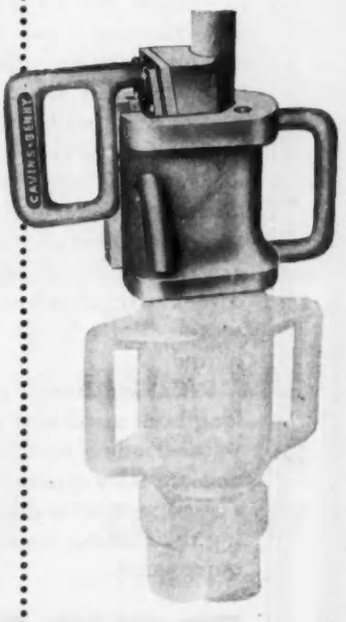
SELF-RELEASING— Clamp removed by relieving the load and lifting the wedge.

Adaptable for setting, servicing or permanent installation. 25,000 lbs. A.P.I. rating.



CAVINS

Refer to Composite Catalog or write for Rod Clamp Bulletin

The CAVINS Co.

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REDA PUMPS

FIRST CHOICE for Secondary Recovery Water Flooding...

The lower the expense of producing source water from wells for water flooding operations, the greater the ultimate profit.

Reda Pumps for source water wells provide many ways for lowering these production costs.

Improved design and longer operating life *lower* the cost of labor per barrel, *lower* the cost of maintenance per barrel, *lower* the investment cost per barrel, *lower* the cost of fluid per barrel.

Also the ability of Reda pumps to produce greater volumes in limiting casing sizes and from greater depths often reduces the number of source water wells required.

Reda engineers have long been associated with water flooding operations and are fully qualified to assist operators in discussing their source water requirements.

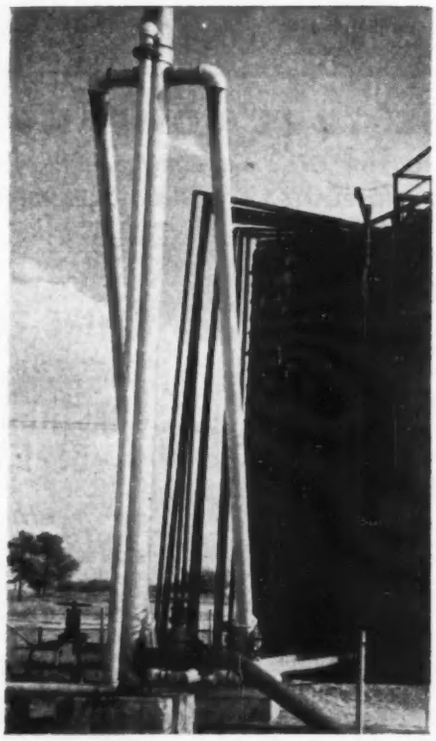
REDA
PUMP COMPANY
BARTLESVILLE, OKLA.

HINTS . . .

and automatically close off the drain line. As the pump continues to operate, a vacuum is created in the suction line, and the pump automatically stops.

If for any reason the discharge line is closed off at the treating station, and pressure builds up in the line, the high-pressure mercury switch will cause the motor to stop, thereby shutting down the salt water pump. In this manner, the pumper may start the pump and make his rounds without fear of the pump burning up.

Another innovation on this installation is the high inverted U-tube on the suction line. Purpose of this tube is to always provide a flooded suction when the pump is stopped. With the suction flooded, the pump will start pumping much easier and does not have to be "primed."



Water Leg Minimizes Damage to Wooden Tank

This self-supporting water leg on a large wooden gun barrel tank mounted away from the tank itself minimizes the damage to the old wooden tank at the flange connections. Instead of just one water drain line as found in most gun barrel tanks, two are incorporated into this installation so that large volumes can be handled easily.

Two parallel four-inch lines connecting to the bottom of the tank

WE CAN SAVE YOU MONEY on Your Flood Water Problems!

As pioneers in the treatment of flood water in the Mid-Continent Area since 1938, our trained staff of water engineers, chemists and bacteriologists are familiar with your every day flood water problems.

Contact us for an analysis of your problem.

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CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less downtime, use world famous Miller Sand Pumps.

PUMP & BAILER SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 In.
Lengths—20, 25, 30 ft.
Composite Catalog, Page 3433

Write for descriptive price list.

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new V-12

WAUKESHA

Diesel **VLR SERIES UNITS** Gas

TURBOCHARGED DIESEL — 1100 HP
LPG — 870 HP • NAT. GAS — 780 HP
NORMAL DIESEL — 800 HP

(Complete unit ratings—1200 rpm)

This powerful new Waukesha is a twelve-cylinder, high compression, overhead valve, 60-degree vee, four-cycle engine of 8½-inch bore and stroke, and 5788 cubic inch displacement. Connecting rods are side by side type; opposing pistons operating from a single wide-area crankpin. Bare engine ratings at 1200 rpm are: Turbocharged Diesel, 1135 hp; Normal Diesel, 830 hp; Butane-Propane, 900 hp; Natural Gas, 810 hp. Response to throttle and load requirements is quick and smooth, with a fast surge of reserve power for emergency and overload demands. Tremendous in power, remarkably rugged, the V-12 is designed for simplicity and reliability. Major parts are interchangeable between right and left cylinder banks. Main and rod bearings are easily accessible. Strength, precision and balance are built into all elements of the power train, from pistons to flywheel. Supporting members are designed for extreme rigidity and perfect alignment of moving parts. Send for Bulletin 1656.

WAUKESHA MOTOR COMPANY

WAUKESHA, WIS.

NEW YORK • TULSA
LOS ANGELES

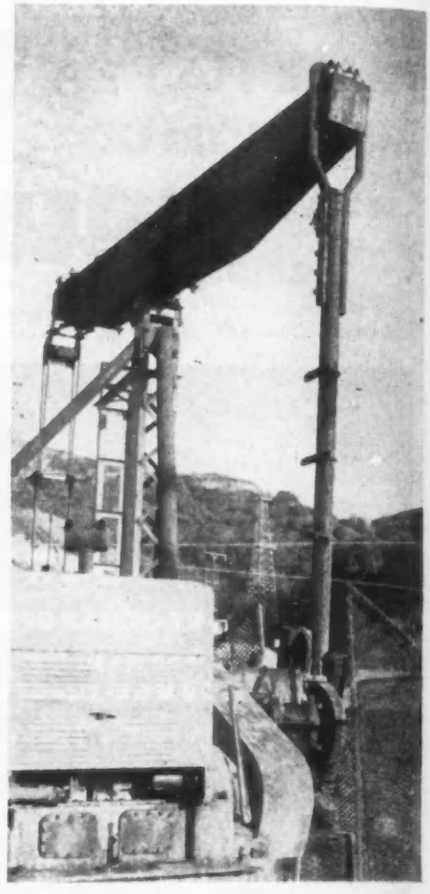
264

HINTS . . .

carry salt water to the water leg riser. Height of the riser is not adjustable, but in this case, where large volumes of water are handled, height of the water-oil interface is relatively high, and minor adjustments are not necessary. The four-inch lines are supported above ground as shown, and approach the vertical water leg at a 45-degree angle, thereby providing support for the vertical riser.

This water leg is 8⅝-inch casing, open at the top and blind flanged at the bottom. It rests on a concrete block which serves as a foundation. Two drain lines, both four-inch, carries the salt water to the treating plant for disposal. These lines are connected to the suction of centrifugal pumps so that all the water flowing into the water leg can be easily removed in either line.

In case of excessive water, and filling of the water leg, a three-inch overflow pipe is installed as shown to carry the overflow away from the tank battery.



Rungs Clamped to Pitman Aid Pumper's Inspection

In many instances where the original derrick and derrick floor have been removed from the well, the standard-end walking beam, unless the sampson post is shortened, thereafter remains unusually high off the ground. Although a ladder normally is provided at the sampson post for lubricating the saddle bearing, access to the tail bearing is more difficult and time-consuming unless a portable ladder is brought to the well, or unless the pumper crawls out to the end of the walking beam.

One company, in order to facilitate access to the tail bearing, clamped, with U-bolts several short pieces of round bar stock to the pitman. Using these rungs, the pumper easily can climb up and inspect or lubricate the tail bearing. Made of salvaged sucker rod material, the rungs can be made up before hand in the welding shop and installed with the aid of only a wrench. They do not interfere in any way with the normal operation of the pumping unit.

22 MODELS

No Job Too SMALL . . . No Job Too LARGE . . . For a JENSEN!

Here you see 2 of the 22 JENSEN models that insure a unit to fit *your* pumping conditions. Correct speed, stroke and capacity—no wasted power.

There are other factors that have made JENSEN the choice of producers all over the world. For example, the one-man combination counterbalance—heavy welding on base, post and beam—double tapered roller type bearings—precision shaved gears—oil bath lubrication.

For all the facts on the engineering masterpieces incorporated in JENSEN Jacks, see your JENSEN Dealer or write us at Coffeyville.

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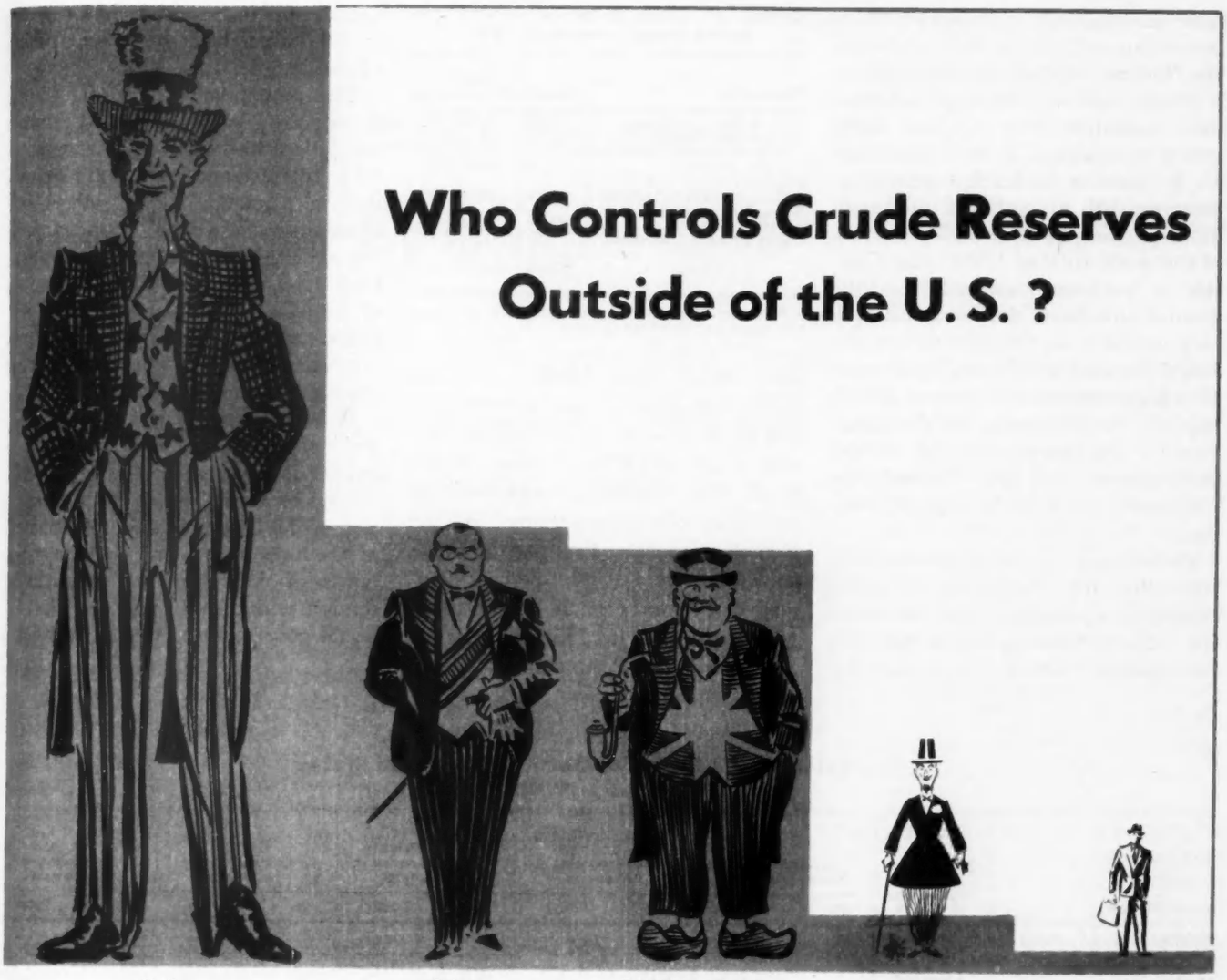
Who Controls Crude Reserves Outside of the U. S. ?



Private U. S. companies are big holders of world reserves. Leading position of North American oil companies abroad is a tribute to completely private capital operations.

By **ROBERT E. SPANN,** WORLD OIL Staff

PRIVATE CAPITAL U. S. oil companies control slightly more than half of the known petroleum reserves outside the U. S., and the volume available to these companies is more than double that controlled by companies identified with any other nationality.

Based on WORLD OIL's estimate of the world's petroleum reserves in 1954, American companies controlled 50.65 percent, or approximately 55.5 billion barrels, of the total existing outside the U. S. While the U. S. interest in foreign oil reserves is largely represented by the far-flung operations of the nation's "Big Five" oil companies—Gulf Oil Corporation, Socony-Vacuum Oil Company, Standard Oil Company of California, Standard Oil Company (N. J.) and The Texas Company—smaller U. S. companies

have an important stake in petroleum operations in Canada, Venezuela and the Neutral Zone of the Middle East.

British and British-Dutch companies constitute the nearest single group competitor to the dominant U. S. position in foreign petroleum reserves, with a combined interest of 21.78 percent, or 23.8 billion barrels, of the world total of 109.7 billion barrels of petroleum estimated in the ground outside of the U. S. Companies included in this group are the Royal Dutch-Shell Group (60 percent Dutch owned and 40 percent British capital), Anglo-Iranian Oil Company (owned 54 percent by the British government) and the Burmah Oil Company (a British capital company).

Government-owned or government-controlled oil companies, reflecting companies operating in nations where the industry has been fully or partially nationalized, such as Argentina, Bolivia, Brazil, Iran, Mexico, and the USSR and Iron Curtain nations, control 23.30 percent, or 25.5 billion barrels, of the world's oil outside of the U. S. The remaining large national petroleum-operating entity is the French company, Compagnie Francaise des Petroles (35 perecnt controlled by the French government) which, through its 23.75 percent interest in Iraq Petroleum Company and its affiliates, controls 3.14 percent, or 3.4 billion barrels, of the world's oil outside the U. S.

The remainder of the oil existing outside the U. S. is controlled through concessions and leases by private capital companies and individuals operating in Canada, Cuba, Argentina, Germany, Japan and Formosa. One individual, C. S. Gulbenkian, through his 5 percent interest in the operations of Iraq Petroleum Company and affiliates, controls an estimated 637 million barrels of the world's estimated reserves outside the U. S.

It is erroneous to state that "control" of underground oil resources in any nation outside of the U. S. constitutes ownership, for with the exception of the U. S. and about 10 percent of the area in Western Canada, ownership of the subsurface rights in all foreign countries is held by the national governments. Where petroleum

Continued on Page 234

Control of Crude Reserves Outside the United States, January 1, 1954

Controller	Percent	Barrels (Thousands)
U. S. Private Interests	50.65	55,550,136
British and Dutch Private and Government Interests	21.78	23,877,527
French Private and Government Interests	3.14	3,448,125
Other Government Interests*	23.30	25,551,250
Other Private Interests	1.13	1,244,083
TOTAL	100.00	109,671,121

* Primarily countries where the oil industry has been nationalized.

Control of Crude Reserves Outside the United States

(Thousands of Barrels)

COUNTRY	Estimated Crude Reserves as of 1-1-54	United States Private Interests		British and Dutch Private and Government Interests		French Private and Government Interests		Other Government Interests		Other Private Interests	
		%	Total	%	Total	%	Total	%	Total	%	Total
Alaska	500	100	500	.....	.....	....	.....	.....	.....	.....	.....
Canada	1,845,422	75	1,384,067	10	184,542	....	.....	.....	.....	15	276,813
Cuba	1,500	.....	.....	.....	.....	....	.....	.....	.....	100	1,500
Mexico	1,400,000	.....	.....	.....	.....	....	.....	100	1,400,000	.....	.....
Argentina	275,000	1	2,750	10	27,500	....	.....	84	231,000	5	13,750
Bolivia	10,000	.....	.....	.....	.....	....	.....	100	10,000	.....	.....
Brazil	40,000	.....	.....	.....	.....	....	.....	100	40,000	.....	.....
Chile	40,000	.....	.....	.....	.....	....	.....	100	40,000	.....	.....
Colombia	400,000	25	100,000	40	160,000	....	.....	35	140,000	.....	.....
Ecuador	26,000	15	3,900	85	22,100	....	.....	.....	.....	.....	.....
Peru	225,000	50	112,500	45	101,250	....	.....	5	11,250	.....	.....
Trinidad	280,000	5	14,000	95	266,000	....	.....	.....	.....	.....	.....
Venezuela	10,138,124	75	7,603,593	25	2,534,531	....	.....	.....	.....	.....	.....
Albania	20,000	.....	.....	.....	.....	....	.....	100	20,000	.....	.....
Austria	200,000	.....	.....	.....	.....	....	.....	100[a]	200,000[a]	.....	.....
Czechoslavakia	7,000	.....	.....	.....	.....	....	.....	100	7,000	.....	.....
France	35,000	.....	.....	.....	.....	....	.....	100	35,000	.....	.....
Germany	317,075	15	47,561	5	15,854	....	.....	.....	.....	80	253,660
Great Britain	4,000	.....	.....	100	4,000	....	.....	.....	.....	.....	.....
Hungary	40,000	.....	.....	.....	.....	....	.....	100	40,000	.....	.....
Italy	5,000	.....	.....	.....	.....	....	.....	100	5,000	.....	.....
Netherlands	100,000	50	50,000	50	50,000	....	.....	.....	.....	.....	.....
Poland	20,000	.....	.....	.....	.....	....	.....	100	20,000	.....	.....
Rumania	400,000	.....	.....	.....	.....	....	.....	100	400,000	.....	.....
U. S. S. R.	9,800,000	.....	.....	.....	.....	....	.....	100	9,800,000	.....	.....
Yugoslavia	10,000	.....	.....	.....	.....	....	.....	100	10,000	.....	.....
Algeria	4,000	.....	.....	.....	.....	....	.....	100[b]	4,000[b]	.....	.....
Egypt	130,000	25	32,500	75	97,500	....	.....	.....	.....	.....	.....
Morocco	8,000	.....	.....	.....	.....	....	.....	100[b]	8,000[b]	.....	.....
Bahrain	250,000	100	250,000	.....	.....	....	.....	.....	.....	.....	.....
Iran	13,000,000	.....	.....	.....	.....	....	.....	100	13,000,000	.....	.....
Iraq	14,000,000	22[c]	3,080,000[c]	52[c]	7,280,000[c]	22[c]	3,080,000[c]	.....	.....	4[d]	560,000[d]
Kuwait	22,000,000	50	11,000,000	50	11,000,000	....	.....	.....	.....	.....	.....
Neutral Zone	300,000	100	300,000	.....	.....	....	.....	.....	.....	.....	.....
Qatar	1,500,000	23.75	356,250	47.5	712,500	23.75	356,250	.....	.....	5[d]	75,000[d]
Saudi Arabia	30,000,000	100	30,000,000	.....	.....	.....	.....	.....	.....	.....	.....
Trucial Coast	50,000	23.75	11,875	47.5	23,750	23.75	11,875	.....	.....	5[d]	2,500[d]
Turkey	25,000	.....	.....	.....	.....	....	.....	100	25,000	.....	.....
Burma	45,000	.....	.....	66.67	30,000	....	.....	33.33	15,000	.....	.....
China	25,000	.....	.....	.....	.....	....	.....	100	25,000	.....	.....
India	46,000	.....	.....	100	46,000	....	.....	.....	.....	.....	.....
Indonesia	1,900,000	60	1,140,000	40	760,000	....	.....	.....	.....	.....	.....
Japan	60,000	.....	.....	.....	.....	....	.....	.....	.....	100	60,000
New Guinea	100,000	60	60,000	40	40,000	....	.....	.....	.....	.....	.....
Pakistan	22,000	.....	.....	100	22,000	....	.....	.....	.....	.....	.....
Sakhalin	65,000	.....	.....	.....	.....	....	.....	100	65,000	.....	.....
Sarawak-Brunei (Br. Borneo)	500,000	.....	.....	100	500,000	....	.....	.....	.....	.....	.....
Taiwan (Formosa)	500	.....	.....	.....	.....	....	.....	.....	.....	100	500
Australia-New Zealand	1,000	64	640	.....	.....	....	.....	.....	.....	36	360
TOTAL	109,671,121	50.65	55,550,136	21.78	23,877,527	3.14	3,448,125	23.30	25,551,250	1.13	1,244,083

[a] Russians exercise complete control. [b] Companies operating here are controlled more than 55% by French Government. [c] Reflects crude oil reserves as allocated on net basis allowing for Anglo-Iranian's 7½% override. [d] C. S. Gulbenkian's share.

Old Tampico Days Recalled Once a Year by Unique Club

With 742 on roster, Tampiqueno Club's Cinco de Mayo reunion annually draws several hundred to recall the role they played in shaping Mexico's history.

By **DON KLIEWER,** World Oil Staff

The Tampiqueno Club of Houston, Texas, a unique organization flecked with international flavor and boasting a club directory of 742 persons formerly associated with the oil industry in and around Tampico, Mexico, was activated in 1946. And, oddly enough, the Mexican government itself laid the groundwork eight years earlier by expropriating oil properties held by foreign entities.

That sudden reversal of government policy and the resultant departure of oil companies uprooted personnel, many of whom found themselves called to other operations spread throughout the world. A number returned to the U.S., and it was a segment of the latter which, eight years later, acted to organize the club, whose roster now reads like a petroleum "Who's Who." It includes an extraordinarily large number of men who occupy executive positions in the oil industry.

And it was in Tampico that they served their apprenticeships in learning to overcome the difficulties of operating in a foreign country under serious handicaps, thus qualifying themselves for the high positions they now hold.

On April 19, 1948, all ex-Tampiqueños known to the group in Houston which was trying to organize the club were invited to meet in Houston on Cinco de Mayo (May 5), date of the commemoration of Mexican independence. Almost 100 attended. It was then the decision was made to perpetuate the club.

From that meeting grew the plan to hold an annual reunion on the Saturday nearest Cinco de Mayo. The event since has grown in popularity so that in 1953 an attendance of 230 was recorded, with the 1954 reunion attended by even a larger group of ex-Tampiqueños and guests.

But the trigger setting off the initial club organizing was pulled as a result of an invitation extended ex-Tampiqueños by the Houston Nomad chapter. Ray L. Dudley, World Oil publisher and charter member of the chapter, offered the suggestion that resulted in the invitation.

Dudley said that since most Nomads, at one time or another, had received courtesies from the representatives of the oil companies that had operated in Mexico prior to expropriation, the Nomad chapter might want to invite ex-Tampiqueños to a Nomad meeting.

The suggestion carried unanimously. Response was spontaneous. Oil companies were requested to supply the names of all employes and former employes who had been stationed in or near Tampico and who were then living in or near Houston.

Meeting A Success. The meeting, held in 1946, was a success. A large number of ex-Tampiqueños met with the Nomads in the Houston Club. James W. (Jimmy) Bradbury, who was with Compañia Mexican Gulf in Tampico and a veteran of 18 years in Mexico, was asked to serve as master of ceremonies since he knew more ex-Tampiqueños than anyone else present.

The reunion, first for the ex-Tampiqueños, proved so enjoyable for them that they voted to repeat it "on their own." And Bradbury was prevailed upon to appoint himself president ad interim. He, in turn, appointed H. S. Kaplan, who also had been with Mexican Gulf at Tampico and who had since returned to Gulf Oil Corporation offices at Houston, secretary-treasurer ad interim. And they have held those offices ever since.

Ex-Tampiqueños journey, in some cases, several thousands of miles to attend the annual reunions, which are permeated with a gay festive air reminiscent of Old Mexico. In keeping with the theme, many of the womenfolk attending the "fiesta" outfit themselves in colorful Mexican costumes.

At the 1954 reunion, President Bradbury—with unanimous club approval—invited Robert Franklin, president of the Houston chapter of Nomads, as a token of appreciation for the role the Nomads played in helping ex-Tampiqueños to organize.

Tasty Treats. Hearkening back to the days of old Tampico, the banquet table is invariably laden with turkey mole, frijoles refritos, guacamole, and other varieties of tasty Mexican food.

Of the 742 names in the club directory, 596 ex-Tampiqueños are scattered over 35 states in the U.S. One hundred and thirty-three registrants live in countries outside the U.S., including Mexico, Venezuela, Colombia, England, Aruba, Belgium, Canada, Cuba, Germany, Indonesia, Jamaica, Kuwait, Lebanon, and Peru.

With dues at $2 a year per family, the organization is held together throughout the year with bulletins prepared by President Bradbury and Secretary-Treasurer Kaplan, with the assistance of club members' offerings of news concerning ex-Tampiqueños and their families. These bulletins are published two or more times a year.

Of the total registrants, 289 are active members. Currently, the club expects many of the 453 inactive members to share that status. Changing of addresses has put the club out of contact with 13 registrants.

That the organization has grown to its present size is a credit to the inherent gregarious nature of members of the oil industry fraternity and to

Continued on Page 234

Tree-lined streets and cool breezes make San Tome living . . .

Luxury on the Llanos

Mene Grande's Venezuelan camp at San Tomé tends to make veterans out of new employes.

By JAMES JOSEPH

THE YOUNG DRILLER, his wife and two youngsters from Texas had expected the worst. "Camp"—especially an oil camp in Venezuela—conjured up a dismal portrait: bleak houses, rutted roads, tough hombres.

They were understandably apprehensive as their plane landed at Venezuela's Maiquetia airport. A bumpy, 1½-hour flight to Mene Grande Oil Company's San Tomé camp in eastern Venezuela did nothing to lessen their fears.

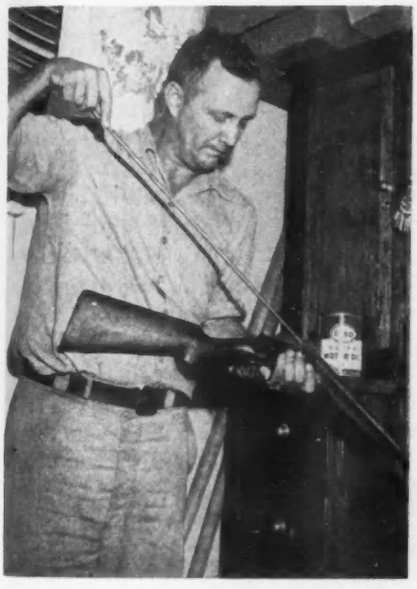
Yet, that first week stunned them.

They found themselves in a tree-scaped town, its 5000-population divided between "north" camp (where staffers, both Americans and Venezuelans live) and "south" camp (home of the field force). Their house, a neat stucco bungalow with red-tile roof, was hidden among tropical trees —Casuarina, Royal Poinciana, African Tulip. Completely furnished with two bedrooms. There was a beautiful school (through junior high), a commissary and a lavish staff camp club —with a swimming pool that looked big enough to be an appendage of the Caribbean. Three times a week movies

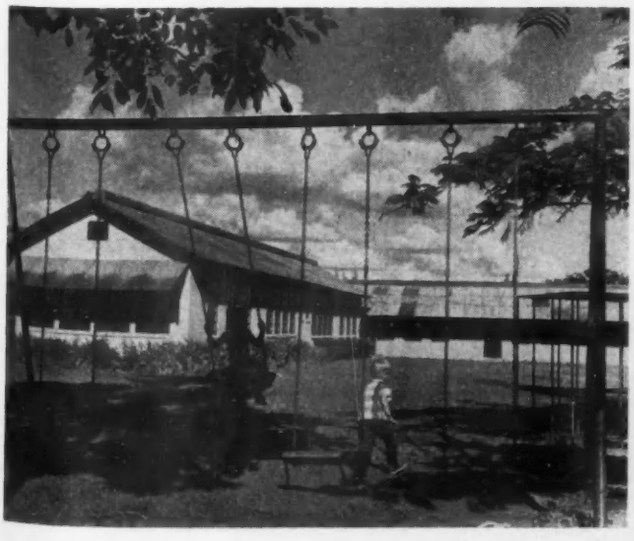
CAMP CITY PROFILE

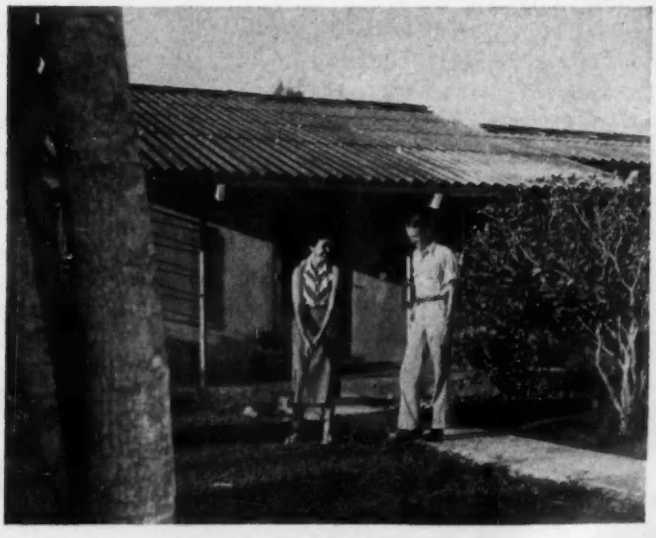
This feature, one of a series describing important oil camps or cities throughout the world, is intended only to describe living conditions and give a bit of local atmosphere. While an occasional one of the features might touch lightly on working conditions, it will do so only incidentally.

HOSPITAL AND HOSPITALITY. San Tome's 100-bed hospital is big and modern (left.) A nursery with hundreds of tropical plants, shrubs and trees is maintained to help beautify San Tomé homes. The foliage is free for the asking with the transplanting thrown in for good measure.



FUN FOR THE FAMILY. Marion Morton (left) oils up his shotgun in preparation for a hunting trip. Deer, jaguar, pigs, tapir and wild turkey abound near the camp. The camp swimming pool (center) is always a popular place. Bowling enthusiasts find they have plenty of spare time for the alleys.





IN THE SWING. In the background the schoolhouse. In the foreground spacious playgrounds for the youngsters. Bachelor Girl Charleen Hennessy (right) gets a few pointers on how to break par. Since arriving in 1951, Charleen has learned to play golf and swim, things she never seemed to find time for in the States.

EATING AT HOME? The San Tomé commissary is like shopping in any stateside supermarket. The well-stocked shelves offer a variety of diet delicacies.

were shown in the club's modern theater.

The driller's wife had her hair done at the beauty shop ($15 for a permanent), bowled a few lines on the club's four alleys, then dropped around to the commissary to buy rolls and bread, fresh-baked in San Tomé's modern bakery. Meanwhile, he was out on the nine-hole golf course trying for par. When it got too dark to putt, he watched night softball under the bright lights, then took a dip in the flood-lighted pool.

One evening he and his wife watched San Tomé's Little Theater stage, "You Can't Take It With You." And before long, his wife joined the Woman's Club, only Venezuelan group of its kind affiliated with the Federated Women's Club of America. Next day they drove out to the nursery, verdant with its encyclopedic collection of tropical trees and shrubs.

"Choose any you wish," the gardener invited, "they're all free, and we'll even transplant them in your yard."

But it wasn't until after a weekend of fishing (they caught 40 whoppers within two hours' drive of camp), that the wife murmured, "I never want to go home!"

Half Are Veterans. Apparently a lot of other San Tomé residents feel the same way, because at least half the camp's families are 7 to 10 year veterans. A few have lived in San Tomé upwards of 15 years—since its founding in 1939. Of course, they can remember when things weren't quite so luxurious. That was immediately after Mene Grande's Oficina 1 came in on May 30, 1937, with an initial production of 2400 barrels a day from 6184 feet.

Shortly thereafter, Mene Grande laid a 100-mile pipe line between Oficina and Puerto la Cruz on the Caribbean. At the line's southern terminus, in Anzoategui State, near the sleepy village of El Tigrito, the company built San Tomé—as a self-contained village. Today, the village is a veritable town. And while this may be disputed, it's probably Venezuela's most livable oil camp.

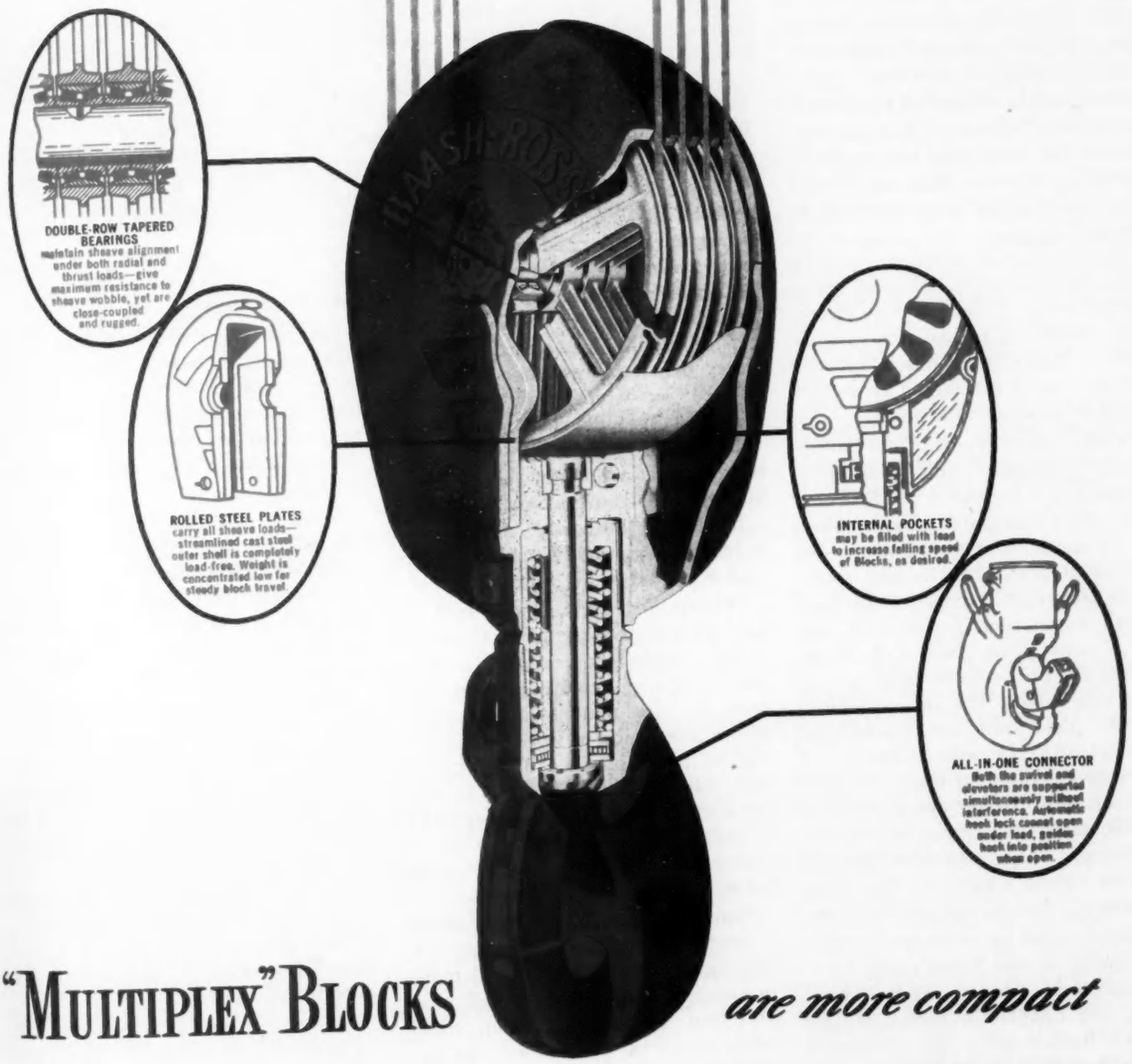
Nor are San Tomé's surroundings what you'd expect. For the camp nestles in grassy flat country—the llanos—which looks like a piece of African veldt transplanted. There's the endless stretch of knee-high grass, sprinkled with scrubby trees—mostly tough-barked chaparros. While the map indicates the beginning of coastal foothills to the north, you'd never suspect their presence. For the horizon is straight and unbroken. Like most of the lowland in Venezuela, it is humid, breezes play along San Tomé's tree-lined streets, and the daytime sun—shining through photogenic clouds—seems to dry things out.

San Tomé's a great place for bachelors—both career men and women. Take pretty, 24-year-old Charleen Hennessy from Coatesville, Penn. Charleen is secretary to W. H. Magness, Mene Grande's chief engineer for eastern Venezuela. She arrived in October, 1951, has learned to golf and swim (things she never found time to do in the States) and loves San Tomé's life. Roommate Betty Moffatt, who works in industrial relations, agrees.

Charleen finds plenty of dating material among San Tomé's bachelors—

EATING OUT? The camp cafeteria offers a menu that's hard to equal. During September, 1953, this cafeteria served 23,000 meals.

The BAASH ROSS "MULTIPLEX"


DOUBLE-ROW TAPERED BEARINGS
maintain sheave alignment under both radial and thrust loads—give maximum resistance to sheave wobble, yet are close-coupled and rugged.
ROLLED STEEL PLATES
carry all sheave loads—streamlined cast steel outer shell is completely load-free. Weight is concentrated low for steady block travel.
INTERNAL POCKETS
may be filled with lead to increase falling speed of Blocks, as desired.
ALL-IN-ONE CONNECTOR
Both the swivel and elevators are supported simultaneously without interference. Automatic hook lock cannot open under load, guides hook into position when open.

"MULTIPLEX" BLOCKS *are more compact*

than any other Block Assembly of comparable capacity

10 Sizes . . . 100 to 300 tons . . . 3, 4 or 5 sheaves.

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but admits that if it's a choice between a good fishing trip and a date, most of the guys reach for their tackle. The solution: learn to fish and like it. And Charleen has.

Outdoors People. San Tomé residents are avid outdoors people. One reason, of course, is that the veldt is habitat for deer, jaguar, pigs, tapir, wild turkey, and a myriad of game birds. The camp has a hunting club, a newly-organized skeet range—and an arsenal of good shotguns (heftiest firearms allowable in Venezuela).

Mention a new-type shotgun shell and a dozen fellows beckon you to a chair on the club's pool-side veranda, order up drinks and say, "Start talkin', feller." And you'd better know your stuff.

San Tomé's 400 Americans receive a monthly cost-of-living bonus. Bachelors' allowance is deducted for board, room, maid service and once-a-week laundry (San Tomé has a modern laundry, but dry cleaning is not included in bachelor's flat rate).

Family houses range from unfurnished "temporary" units to modern, completely furnished, 4-bedroom homes. Bachelor and family dwellings are all one-story stucco, and are intermingled along San Tomé's shady streets. About 80 percent of the staff camp's population is American, the rest Venezuelan. Non-staff Venezuelans live in the south camp, a neat little city which has its own club, church, plaza, markets, stores, and recreational facilities. Others live either in El Tigre, a town 12 miles west of San Tomé (population: 20,000) or in El Tigrito, three miles southwest. These town-dwelling oil families receive a monthly day living allowance, plus regular union wages.

Most families eat some meals "out" —meaning in San Tomé's big, modern cafeteria (during September, 1953, the cafeteria served 23,000 meals). Backstopping the cafeteria is a spanking-clean kitchen (which often goes in for such fancy pastries as chocolate eclairs), a six-man bakery (bakes as many as 720 rolls a day, all kinds of bread and pies) and an ice plant.

Chief Mess Steward Charles Domon runs the kitchen and its environs and supervises the making of ice cream—a daily chore. Jack Reynolds heads the Camp Service department, charged with supplying baked goods to the commissary, as well as looking after San Tomé's bungalows and its bachelor quarters.

For the Children. San Tomé's stucco, red-tiled school building has a spacious, supervised playground for the children, 13-fully accredited American teachers. Spanish is compulsory for pupils and for some of their parents, especially for the breadwinner. On Sunday, the little school becomes a Protestant church, visited by an itinerant minister who preaches at various other oil camps in the vicinity.

Although San Tomé is about 350 miles by all-weather road from Caracas, many camp residents are just as ardent race fans as the city folk. And if Caracas' tipsters ever doubted San Tomé's penchant for picking the winners, all doubts was erased last May, when oil worker Charlie LeHigh guessed six winners out of six in Venezuela's fabulous "Cinco y Seis" ("5 and 6") and won $300,000—biggest turf jackpot in the country's history. Charlie was a San Tomé hero, a headlined "authority" and also its richest citizen, until Uncle Sam's tax men got wind of his winning.

"Camp life," a young wife said, "is fun—except for the whistles." If there's anything objectionable about San Tomé—or any other Venezuelan camp for that matter—it's arising to the whistle, going to work and knocking off to its banshee blast. And at San Tomé work begins at 7 a.m. (the mess hall serves breakfast beginning at 5:45 a.m.).

But few complain. "Look at the pretty sunrises we see," they say.

San Tomé has an athletic director —necessary when you consider that there are at least ten baseball teams in camp, including intramural nines and San Tomé's first team, which plays tourneys with other eastern Venezuelan camps. Annually, there's a hotly-contested intercompany series —"Big League" in eastern Venezuela —between teams fielded by Creole Petroleum Corporation, Socony-Vacuum Oil Company and Mene Grande.

And when San Tomé's Club throws a dance, such as a big holiday formal, it hires only the best—Billos Caracas Boys, 15 rocking-good musicians, stars of radio and TV.

Library and Hospital. On the more studious side is San Tomé's 2000-volume library, which operates a regular lending service. The camp's 100-bed hospital (probably most modern in eastern Venezuela) is free to employes, charges only nominal fees for others in the family and but $33 for maternity cases.

One day I dropped around to Marion Morton's home (he's an eight-year San Tomé veteran and a machinist in its big shops). I wanted to talk about hunting and fishing. And Marion's an expert. He was born in Bakersfield, Calif., hunted his home area and a half dozen western states besides. I found Morton oiling his arsenal—a necessity in San Tomé's high humidity.

"In just two days, fingerprints rust right into the barrel," Marion told me. "Gotta oil these things all the time. And keep them in a dry closet. As for leather carrying-cases—leave them at home. The climate's rough on leather."

What about San Tomé hunting? "Tops," he said, "but we've driven the game farther back now. Used to be—say five years ago—you couldn't drive a truck over that veldt without practically running down game. Now you've got to go looking for them."

One who did was Bill Knoderer, a San Tomé oldtimer. And the photo he's got of a 300-pound jaguar seems to prove that he found it. The jaguar, incidentally, measured 7 feet from muzzle to rump ("no fair including the tail," Knoderer says).

Plenty of club doings in San Tomé, too. There's a branch of the Venezuelan Lions and Rotary clubs, and San Tomé Post 1, chapter of the American Legion.

With San Tomé's varied social life, its active organizational program and recreations, little wonder that intrepid young driller's family decided, after only a week, that they'd found their niche. And, if they're like the average San Tomé family, they'll still be living in their stucco bungalow, set around with tropical trees, for another 7 or 8 years. For San Tomé just sort of grows on you. —**The End**

What's Happening

AMONG WORLD OIL MEN

Los Angeles Nomads

Attending a recent meeting of the Los Angeles Chapter of Nomads were, standing, left to right, M. Hulshiza, D. & E., Arabia; E. Arch Brown, formerly with Shell Oil Company, Venezuela; A. C. Martin, Gulf Oil Corporation, Tunisia; Lee E. Courteau, Gulf Oil, Sicily; Jack Stovall, D. & E., Dhofar; W. C. Lance, Iraq Petroleum Company, Qatar; Patricio de Solar, Santa Fe Drilling Company, Chile; Harold D. Devenish, Trinidad Oilfield Service, Trinidad. Seated, left to right, are Gus J. Jure, D. & E., Arabia; W. P. Ries, IPC, Bahrain; Roy C. Zornes, IPC, Iraq; Stan Hill, who spoke at the meeting; H. H. Mitchell, IPC, Iraq; and T. M. Webb, The Texas Oil Company, Venezuela.

Stanolind Oil and Gas Company has announced the appointment of three top Producing department men in the Calgary division office.

M. C. HOFFMAN will become division production superintendent; SIDNEY B. RICHARDS, division engineer, and C. E. DAGLEY, division clerk.

C. O. HOPPER, district superintendent, will be transferred to Edmonton to manage Stanolind's producing office.

Hoffman returns to Stanolind after several years' service with Root Petroleum Company and Pan-Am Southern Corporation. He went to Root in 1949 as general manager of production and exploration, and when that firm became part of Pan-Am Southern, Hoffman was named vice president for production and exploration for Pan-Am Southern. Pan-Am Southern recently announced that it was disposing of most of its production operations to Stanolind.

Hoffman first became associated with Stanolind in 1931 as a gas engineer in Tulsa. Subsequently, he served as division petroleum engineer in Fort Worth, and chief production engineer and general superintendent of the Producing department in Tulsa before going to Root.

Hoffman is a native of Colorado and a graduate of Colorado Agricultural and Mechanical College.

Richards, the new division engineer, joined Stanolind in 1939 following his graduation from the University of Oklahoma with a degree in petroleum production engineering. He served in several engineering capacities and was named assistant division engineer in Casper, Wyo., in 1947. Prior to his new Calgary assignment, Richards has been petroleum engineering supervisor in Stanolind's general office in Tulsa, Okla.

Dagley, the new division clerk, has been in Canada since 1952, transferring there from Houston, Texas. He joined the company in 1941 and worked in the Gulf Coast areas of Texas in various clerical positions. He has been serving as district clerk in Calgary since April. Dagley served in the U. S. Air Force from 1943 to 1945.

FRANK A. MORGAN, who recently resigned as vice president of Richfield Oil Corporation, has been appointed director and technical advisor of Ampol Exploration Company of Sidney, Australia.

Morgan has been active in the geological profession since 1920 and, in 1952, was president of the American Association of Petroleum Geologists. As head of Richfield's exploration department, Morgan has been responsible for many important oil field discoveries in California during the past 15 years. Foreign assignments given him while with Richfield included Australia, Canada, Mexico, South America, North Africa, and the Middle East. He is a director of Halliburton Oil Well Cementing Company.

•

CHARLES C. (CUB) FRYE has been appointed chief engineer of Hudson's Bay Oil and Gas Company, Ltd., Continental Oil Company's Canadian affiliate.

Frye received his BS degree in electrical engineering from Oklahoma A. & M. College in 1930. After a short time with General Electric Company, he joined Continental Oil Company at Ponca City, Okla., in 1933 as a petroleum engineer. In 1948 he became regional petroleum engineer for Conoco at Denver, which position he held at the time of his transfer to Calgary.

•

RISER EVERETT, formerly district geologist for The Carter Oil Company at Jackson, Miss., has been transferred to Palembang, Sumatra, where he has been named to the position of chief geologist for the Standard-Vacuum Petroleum Maatschappij.

Riser Everett

a WORLD of OIL

By **DON KLIEWER,** WORLD OIL Staff

Australia: Oil Drilling and Exploration, Ltd., is operating three drilling rigs in Australia. The company also owns a 20 percent interest with Lucky Strike Drilling Company of Tulsa in a well being drilled in the Maryborough Basin of Queensland, eastern Australia. . . . Oil Drilling currently is setting up a consulting geological service. . . . Associated Freney Oilfields N. L., holder of three small exploration areas in the Fitzroy Basin, plans to drill on the Nerrima Dome, which is adjacent to the Grant Range structure.

Germany: Gewerkschaft Elwerath has discovered a new oil field in South Holstein, near Hamburg, with what is possibly the deepest producing well in Western Germany. The well, 7874 feet deep, is producing 24.7 barrels a day. It is the fifth oil field in Schleswig-Holstein and the second oil discovery there this year. . . . A second well, Bramstedt 4, has flowed oil in the newly-discovered Bramstedt field in Holstein province, belonging to the joint interest Dea-Preussag-Deutsche Vacuum. The well is 1500 feet northeast of discovery well, Bramstedt 3a. Flow tests from the Dogger gamma yielded eight barrels of crude hourly through a 1/10-inch choke from 6250-6260 feet.

Cuba: Echevarria 1, the Jatibonico discovery, and the two offset wells are producing a total of 700 barrels daily of low sulfur oil. . . . Location has been made for Echevarria 4.

Iraq: Mosul Petroleum Company has produced almost 18.7 million barrels of crude from Ain Zalah and Butmah fields. . . . Government Oil Refineries Administration has accepted as satisfactory tests conducted by Iraq Petroleum Company engineers on the new 130-mile, 12-inch oil pipe line between Baiji and Dora which were undertaken before IPC handed the line over officially to GORA.

Libya: A new oil exploration law will be drafted by government officials.

Mexico: A second test in the Tecolutla area on the Gulf of Mexico, drilled a mile from the discovery well Miguel Hidalgo 1, has struck oil, causing Petroleos Mexicanos, the government oil agency, to revise reserve estimates of the new field to approximately 250 million barrels. Miguel Hidalgo 1, with production put at about 3000 barrels daily, is in Vera Cruz State, and it found production at 7590 feet.

Neutral Zone: American Independent Oil Company has discovered a new Middle East producing horizon in porous limestone at 6760 feet, with an indicated daily flowing rate of 2400 barrels of 25.6 gravity crude on drillstem test. The discovery well is on the Wafra structure in west central Neutral Zone, where Aminoil and Pacific Western Oil Corporation have 15 wells producing from the shallower Burgan horizon at about 3500 feet.

Bolivia: With production now at 10,000 barrels a day, the Bolivian government is expected to revise its petroleum laws to attract foreign private capital help in the current minor oil boom.

China: The joint Sino-Soviet Petroleum Company claims discovery of "many new oil-bearing structures" in the Tsaidam basin of Chinghai Province and in the Turfan Basin of Sinkiang Province, a remote region bordering Russia.

Yugoslavia: Oil has been discovered in depths between 3937 feet and 5577 feet at Kutina, 75 miles east of Zagreb, the capital. . . . Thus, Kutina's importance as an oil center has increased to the extent that 1954 production of about 1,214,000 barrels is expected to rise to 1,451,035 barrels in 1955. . . . After developing proven areas between Kutina and Zagreb, annual yield of 6,750,000 barrels is expected, in addition to enough natural gas to supply Zagreb's needs. . . . A rich oil and gas deposit reportedly has been discovered at 8038 feet, very deep for Yugoslavia, near Oskovo; a second well nearby is scheduled to drill to 9850 feet. The second well already has produced oil and gas.

Eastern Germany: Unconfirmed reports say that two test wells drilled west of Salzwedel, probably near Waddekath, and the deep well on Ettersberg mountain, near Weimar, have discovered oil.

Brazil: Two crews of Prakla, Hanover, Germany, are conducting large-scale gravimetric and magnetometer surveys along the Amazon river.

Chile: The government is continuing its consideration of legislation aimed at allowing outside foreign capital to conduct exploration and development activities.

Spain: Bids from domestic contractors are expected to be sought early this year for a projected 600-mile 10-inch pipe line to be built by the U. S. to serve U. S. bases in the country.

Venezuela: Both U. S. and French organizations reportedly have submitted bids to the government which, in a move reversing its policy established in 1945, has quietly indicated it would take bids on new oil concessions. No announcement of awards has been made.

New Guatemala Oil Code Details Are Released

Four types of concessions are to be allowed under Guatemala's new draft petroleum code. They are permits for exploration, development, processing, and transport.

Underlying the new code is the proclamation that the nation owns the oil deposits. Provisions include:

- Only Guatemalan nationals and companies are allowed to acquire concessions. The code considers as Guatemalan companies those constituted in Guatemala with boards of directors numbering at least a third Guatemalan nationals.
- Exploration concessions are to range between approximately 12,350 acres to 495,000 acres.
- Development concessions are not

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to exceed half the size of the corresponding exploration concessions, with a minimum of about 2500 acres.

- Concession periods will be set at 40 years with possible renewal of 20 years.
- Annual exploration tax will rise from 50 cents the first year gradually up to $1.50 in the fifth year. Companies will be permitted to deduct operational costs annually up to 80 percent of total taxation.
- Annual development tax will rise from $1.50 for each 2.47 acres in the first year up to $11.
- The Guatemalan government will retain a 16 percent share in all oil produced.

335 Rotary Rigs Active In South American Areas

At the close of the year, rotary rigs were active in the following countries as indicated.

Country	No. of Rigs
Venezuela	107
Mexico	82
Argentina	47
Trinidad	27
Colombia	22
Peru	21
Ecuador	9
Brazil	8
Bolivia	6
Chile	5
Barbados	1
Total	335

World Crude Reserves

(Continued from Page 222)

operations are open to private capital companies in these latter nations, it is through concessions to oil companies for a definite period of years.

The concessionaire oil companies in these countries "control" the oil reserves in the sense that they are permitted to operate the properties under concession during the life of the concession—unless it is revoked earlier by the government as has been the case in several countries through "nationalization."

The leading position of U. S. oil companies abroad as well as in the U. S. is a striking tribute to completely private capital operations. In many lands in the search for oil, these companies have competed with government-owned, government-controlled or government supported companies in the search for and production, refining and marketing of petroleum and its products. The entry of American petroleum capital abroad was not backed in any way by the U. S. government, except for a short period of token diplomatic support, compared with the entry of British, British-Dutch and French companies with the full diplomatic and in some cases, financial support, of their respective governments.

While there were some small investments by U. S. oil companies abroad, largely in Mexico and Rumania, prior to World War I, the real start of American interest in foreign petroleum came in 1919 when U. S. oil companies were given short-lived diplomatic support to go abroad and develop oil sources. The near scarcity of petroleum supplies in World War I and the fear that the combination of British-Dutch-French interest, which through various treaty mandates had control of most of the undeveloped oil areas of the world—particularly in the Middle East—provided the impetus to urge American companies to look abroad for oil. In the early 20's there was a strong urge to form a single "United States Oil Corporation," which with capital supplied by various American oil companies and supported by the U. S. government, would enter the foreign field, but the wiser decision to permit competitive American companies to individually find and develop their own supplies abroad prevailed.

The results are readily apparent. U. S. oil companies controlled 16.5 percent, or 2 billion barrels, of the reserves outside the U. S. in 1928; 22.1 percent just before World War II in 1939, an 40.1 percent in 1945 at the start of the postwar race to develop large resources of petroleum overseas. Total volume of estimate reserves controlled by American companies in 1945 was placed at 17.4 billion barrels, based on data presented to the U. S. Senate in its hearings investigating the activities of U. S. oil companies abroad. The increase in reserves available to U. S. companies in the postwar period, therefore, has been more than 220 percent to the total of 55.5 billion barrels at the start of 1954.

Revised estimates of underground world petroleum reserves as of January 1, 1955, are now being prepared by World Oil and will be published in the February 15 Forecast and Review Issue. While total reserves available to U. S. companies will increase, reflecting the high level of exploratory effort during 1954, the total percentages of control of the available foreign reserves by nationalities are expected to remain almost unchanged.

By major areas, all exclusive of the U. S., American oil companies at the beginning of 1954 controlled 63.1 percent of the estimated crude reserves in the Western Hemisphere; 22.5 percent in Africa; 55.1 percent in the Middle East, and 44.4 percent in the Far East. British and British-Dutch companies controlled 21.9 percent of the reserves in the Western Hemisphere; 68.3 percent in Africa; 23.4 percent in the Middle East, and 51.8 percent in the Far East.

Government-company ownership has its most important influence in Europe, where, due to the complete government ownership in Russia and satellite nations, the government companies controlled 96.3 percent of the underground crude reserves. In the Western Hemisphere, outside the U. S., government companies control 12.3 percent of the total reserves.

—**The End**

Tampiqueno Club

(Continued from Page 223)

the devotion exhibited by President Bradbury and Secretary-Treasurer Kaplan, in addition to other officers.

Popular President. Though President Bradbury supported in the club by-laws an approved policy that no officer should serve more than two years, the membership has consistently overruled its own ruling by retaining both Bradbury and Kaplan in their offices year after year.

Other officers are A. J. (Tony) Mendive, who was an independent contractor in Tampico and who now is president, Non-Corrosive Products Company of Texas, Houston, and Emory T. (Kink) Adams, who was with Mexican Sinclair Petroleum Corporation and who now is associated with Kerotest Manufacturing Company, Houston, vice presidents; and Allen P. Berry, with The National Supply Company and Sheldon & Burden in Mexico and now with Magnolia Oil Company, Houston, assistant secretary-treasurer.

And once a year these officers arrange the reunion that brings together many of the ex-Tampiqueños to afford them the pleasure of reminiscing about the "days of old Tampico."

What's Happening

AMONG MEN IN THE INDUSTRY

Robert Fisher

S. T. Crossland

The **Texas Company** has announced the election of **Robert Fisher** as financial vice dent and **Stanley T. Crossland** as vice president and treasurer. Fisher, treasurer since 1949, succeeds **L. H. Lindeman,** who retired. In addition, **Robert G. Rankin,** assistant comptroller, has been appointed to the newly-created position of director of the budget, **William R. Love,** special auditor in the Comptroller's department and assistant to Rankin, will succeed the latter as assistant comptroller.

R. G. Rankin

•

Delta Gulf Drilling Company has promoted **R. L. (Bob) Williams** to toolpusher in its West Texas division with headquarters at Odessa, Texas.

•

E. W. Brake, area superintendent of production for **Gulf Oil Corporation** at Seminole, Okla., is moving to Oklahoma City to become zone superintendent. **D. D. (Jack) Adams,** area exploration manager, becomes zone manager of exploration.

•

Max S. Sons, The Carter Oil Company, Tulsa, has been promoted from chief petroleum engineer to an assistant chief of research at Carter's research laboratory. **P. D. Baker,** formerly assistant chief petroleum engineer, succeeds Sons, and **G. C. Hollinger** who has been Carter's southern division engineer at Shreveport La., has been transferred to Tulsa to succeed Baker.

•

F. A. Menken, vice president and exploration manager of the Western Division, **Tide Water Associated Oil Company,** has announced his retirement from the company to enter private consulting practice. Menken started with Tide Water in 1926 and since 1936 has headed the Exploration department of the Western Division.

William A. Bramlette has been appointed chief geologist of **The Carter Oil Company** to succeed **Merrill W. Haas,** who became manager of the company's Exploration department. Bramlette began his career with Carter in 1943 as a senior geologist in Billings, Mont. Three years later he became district geologist in the Northwest division. In 1948 Bramlette became assistant division geologist of the Western division and later was made division geologist. He transferred to Tulsa as assistant chief geologist in 1953.

•

Julian W. Glass, Jr., has been named president of the **Panhandle Producing Company.** Glass served as vice president and director for the corporation since the death in 1952 of the late J. Wood Glass, first president and founder of the company. In addition to duties as president, Glass is also a director. Other officers and directors are **F. Wallace Hall,** Amarillo, vice president; **Irene Stimson Cox,** San Antonio, secretary-treasurer; **Eva Payne Glass,** Nowata, and **A. A. Eason,** San Antonio, directors.

•

George H. Freyermuth, who began with **Standard Oil Company (N. J.)** 26 years ago as a chemical engineer, has been elected executive vice president and a director of **Esso Export Corporation.** His first position was as a chemical engineer at the Esso refinery at Baton Rouge in 1928. Later he became a research engineer for Standard Oil Development Company, central research affiliate of the Jersey Standard organization. From research Freyermuth moved to the Sales department of Esso Standard Oil Company, to head the section handling development and application of fuels and lubricants. He was assistant manager of sales engineering for that company in 1943 when he transferred to Standard Oil Company (New Jersey), joining the newly organized Public Relations department. The next year he became manager of that department, the position he leaves to join Esso Export,

George H. Freyermuth

•

Stewart Schackne has been appointed manager of the Public Relations department of **Standard Oil Company (New Jersey).** An assistant manager of the department since 1945, he succeeds **George H. Freyermuth,** recently elected executive vice president and a director of Esso Export Corporation.

G. E. Wagoner

R. D. Sloan

R. D. Sloan, Denver, has been named division manager of **The Carter Oil Company's** western division. Sloan will replace **George E. Wagoner** who has been appointed exploration advisor of International Petroleum Co. Ltd. at Coral Gables, Florida. Sloan started work for The Carter Oil Company as geologist in Tulsa in 1934, and four years later was promoted to district geologist. He was transferred to Billings, Mont., as division geologist in 1945, and was made division exploration manager a year later. He became Western Division exploration manager at Denver in 1948.

Wagoner began his oil industry career in 1930 as an employe in the Humble Oil and Refining Company's Geological department. After four years with Humble, he transferred to Carter as a seismograph computer. In 1936, he joined the Standard Oil Company of Louisiana as chief geophysicist. He served in this position for a year before returning to Carter as assistant chief geophysicist. Wagoner was made Carter's Southern Division exploration manager at Shreveport, La., in 1946 and became manager of the company's Western Division at Denver in 1953.

•

Humble Oil & Refining Company has announced changes in the Production department supervisory personnel. **R. J. Schilthuis** has been named assistant manager of the Production department in charge of natural gas production, casinghead gas plants and gas transportation to replace **John O. Sue,** who has retired. **John J. Carter,** takes over the former position held by Schilthuis, division superintendent of the Gas division. **John Yearger,** gas superintendent, Louisiana division, will be acting assistant division superintendent of the Gas division for a six-months training assignment.

•

Daniel A. Busch has resigned as manager of exploration for **Zephyr Drilling Corporation** and is now a consulting geologist with offices at 1110 First National Building, Tulsa.

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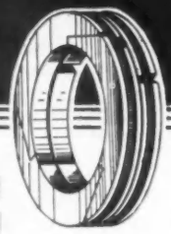

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Merle Becker, former president of the IPAA, has been appointed manager of oil industry relations of **D. D. Feldman Oil and Gas of Dallas.**

Merle Becker

In the new post just created, Becker will be responsible for all the organization's oil industry contacts. After graduation, Becker worked for banking, investment and manufacturing companies before entering the petroleum field through W. C. McBride, Inc., independent. Becker was executive vice president of the McBride organization for five years before leaving in 1950 to operate as an independent.

•

Graham B. Moody, chief reserves engineer on the executive staff of **Standard Oil Company of California**, has retired. Moody, who completed 34 years of service with Standard, will go into private business as a consultant in petroleum geology with offices at 35 Stonewall Road, Berkeley, Calif. Moody served Standard in the Philippines, Mexico and a major portion of the southwestern U. S. He was named senior reserves engineer in 1944 and chief reserves engineer in 1951. In the latter capacity, he functioned as consultant to engineers of wholly-owned subsidiaries and the parent company.

•

Charles N. Pollak has been appointed manager of the Public Relations department of **Tide Water Associated Oil Company.** He will plan, develop and coordinate the company's national public relations activities and will have headquarters in San Francisco. Pollak served as a United Press correspondent in Buenos Aires, Argentina and at United Nations, N. Y. He spent 2½ years with Creole Petroleum Corporation's Public Relations department in Caracas and Maracaibo, Venezuela.

•

Carter Oil Company has announced the appointment of **E. C. Wells** and **W. F. Eiting, Jr.**, to staff assistants in the Production department. Wells at present is assistant to the manager and Eiting is production manager for the Eastern division. **O. N. Knox**, general superintendent of production, will become assistant to the manager. Other appointments include **R. C. Curtis**, production manager of Carter's Northern division, Billings, Mont., to Eastern division production manager, Mattoon; **J. Roy Dorrough**, production staff assistant of the Southern division, Shreveport, La., to Northern division production manager, Billings; **Howard C. Kauffman**, division engineer of the Western division, Denver, to production staff assistant in the Southern division, Shreveport; **William S. Stovall**, staff engineer at Oklahoma City's Central division headquarters to division engineer for the Western division, Denver; **L. Max Lyon**, district engineer, Seminole, Okla., to the Central division engineering staff at Oklahoma City and **John B. Campbell**, senior petroleum engineer, to district engineer at Seminole.

•

Dr. M. King Hubbert, a Houston geologist, received one of science's highest honors when he was awarded the Arthur L. Day Medal of the Geological Society of America for "distinguished application of chemistry and physics to geology." The presentation was made at the Society's annual meeting in Los Angeles.

M. King Hubbert

Dr. Hubbert, who is chief consultant in general geology for the **Shell Oil Company**, has had a background of outstanding achievements in the field of geology and geophysics since receiving his bachelor's degree from Chicago University in 1926. He received a Ph.D. from the same institution in 1937. Among the best-known of his many contributions are the *Theory* of *Scale Models*, a treatise written at the request of a National Research Council Committee on the Borderland Fields between Geology, Physics and Chemistry, and his *Theory* of *Ground-Water Motion*, which was the foundation for his reputation today as one of the petroleum industry's leading authorities on the hydrodynamics of underground fluids.

•

John W. Gendron has been appointed manager of the Oil Purchase and Exchange department, **Tide Water Associated Oil Company**, a newly-created position. Gendron entered Tide Water's service as a stock dispatcher in its western Transportation department upon returning from duty in the U. S. Navy. He was assistant manager of the Western division's Crude and Products department from 1951 to 1952 and manager of the department since 1952.

John W. Gendron

•

Herbert W. Grindal has been elected a director of **Cosden Petroleum Corporation**, succeeding **B. H. Roth**, who retired.

•

Kenneth C. Woodyard, Houston, has been promoted to the newly-created position of division geophysicist for **Continental Oil Company**, with headquarters in Shreveport, La. He formerly was associated with Conoco's southern region headquarters geophysical section at Houston. Woodyard joined Conoco's geophysical section at Ponca City, Okla., in 1932 and held several positions on company seismograph crews in the Southwest before transferring to Houston in September, 1954.

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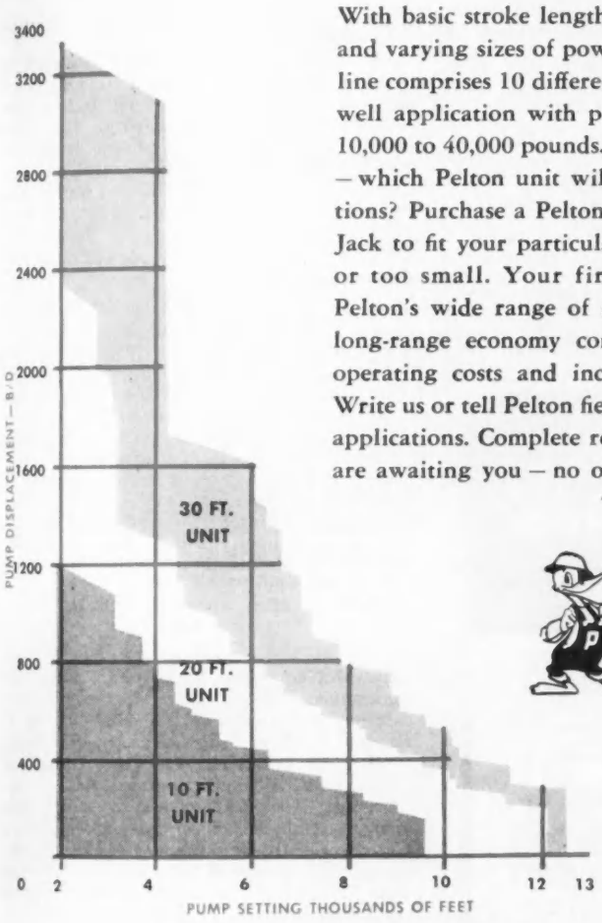

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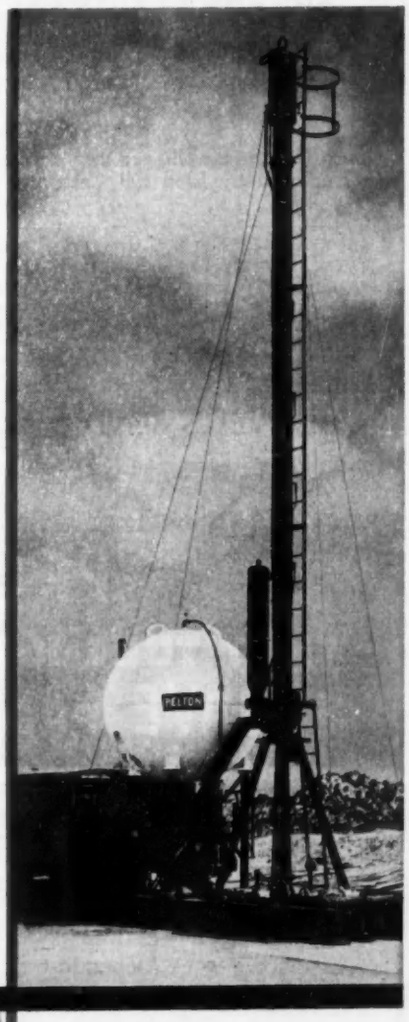

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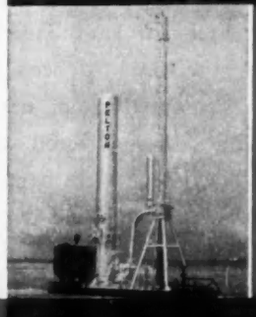

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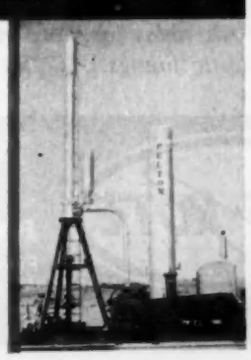

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Jack A. Ramsdell, Calgary, Alberta, Canada, has been appointed geophysical supervisor for Continental Oil Company, with headquarters in Jackson, Miss. He formerly was a geophysicist in Canada with Hudson's Bay Oil & Gas Company, Ltd., an affiliate of Continental Oil Company. Ramsdell was born in Denver, Colo., and received his bachelor's degree in 1949 in geological engineering from the Colorado School of Mines. He joined Conoco in 1949 and served on geophysical crews in several states before transferring in late 1953 to Calgary and Hudson's Bay Oil and Gas Company.

•

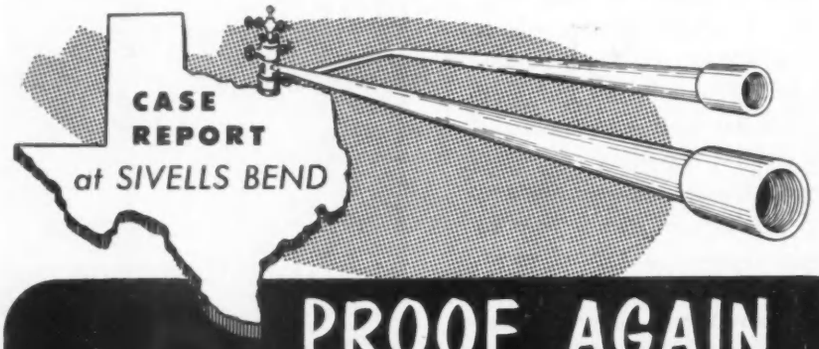
Richard Huntington Bosard has recently been employed by **Lion Oil Company** as an oil scout. Bosard will be attached to the district office at Billings, Mont. A native of Billings, he was educated at Eastern Montana College of Education and the University of Montana.

•

John S. Tate has been appointed assistant treasurer of **Standard Oil Company of California.** Tate joined Standard in 1947 after obtaining a master's degree in business administration from Stanford University.

•

Earl E. Wall has joined the staff of **The Louisiana Land and Exploration Company** in New Orleans as petroleum engineer. Previously, Wall served with Brown Brothers et al as field petroleum engineer at Post, Texas.



PROOF AGAIN
THAT TUBE-KOTE PIPE LININGS
SAVE PRODUCTION TIME

In the Sivells Bend Field in Cooke County, Texas, a major oil company was having trouble with heavy paraffin deposition in flow lines during the winter months. These were surface flow lines and paraffin had to be removed by hot oil circulation as frequently as twice a week, depending upon the severity of the cold weather.

To eliminate this problem, they installed 4500 feet of 2" flow line pipe which had been coated with Tube-Kote's TK-2 plastic lining. The TK-2 lined pipe has now been in service for *SIX YEARS* and no paraffin accumulation has occurred despite the fact that this line has at times been covered with snow and ice. Some of the joints of the coated pipe were bent to go around corners, yet even these sections had no paraffin deposition.

Such excellent service obtained by Tube-Kote linings has caused this oil company and others to specify Tube-Kote lined pipe.

Write today for more information about Tube-Kote plastic linings. Ask for TK-2 and TK-4 Bulletins

TUBE-KOTE

TUBE-KOTE, INC.
P. O. Box 20037
HOUSTON 25, TEXAS
Pioneers in plastic linings for pipe since 1939. Manufacturers-extruders of plastic pipe for the oil industry.

Roderick K. MacIvor has resigned as division water flood engineer for Sohio Petroleum Company to organize the **MacIvor Engineering Company**, Room 616, Braniff Bldg., Oklahoma City. MacIvor graduated from Kansas University with a B.S. degree in 1946 and obtained his M.S. degree from the University of Tulsa in 1948. He joined Sohio the same year and was assigned to water-flood operations in Illinois and Oklahoma, later engaging in water-flood research in Sohio's research laboratory in Oklahoma City. In 1949 he was assigned to reservoir engineer work in Oklahoma and West Texas and later to water-flood evaluation and economic analysis. His petroleum consulting firm will specialize in water-flood operation, evaluation and property management.

Roderick K. MacIvor

•

Bates & Cornell, composed of Fred W. Bates, Jay B. Wharton, Jr., Robert R. Copeland and Mark W. Mitchell, petroleum geologists; and Drew Cornell and Paul Montgomery, petroleum engineers, have terminated their partnership as of January 1. The former partners will operate as individuals and all of their previous functions as consultants and as an independent operator will continue. The same technical and field staff will be maintained. A company will be formed for the purpose of operating properties for themselves and others.

•

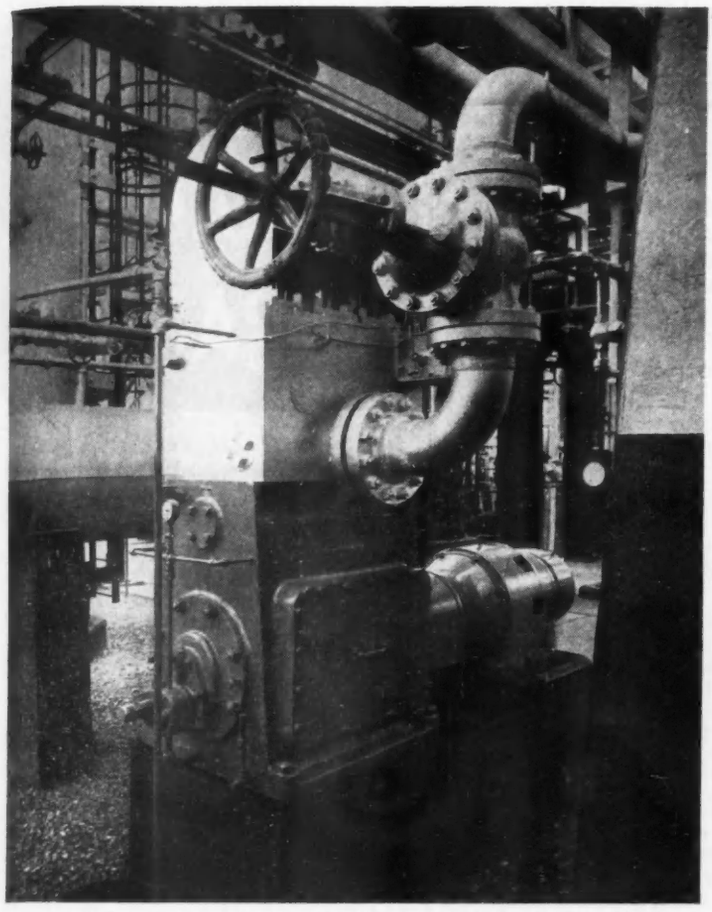
Kerr-McGee Oil Industries, Inc. has announced the following personnel promotions and organizational changes: **W. F. Baxter,** manager of drilling operations, Gulf Coast division; **G. Otis Danielson**, manager of drilling operations, Mid-Continent and Rocky Mountain divisions; **Sam King,** manager of industrial relations; **Charles F. Miller,** manager, Production department; **George B. Parks,** general manager, Production department and drilling operations; **Burrell Taylor,** general superintendent, Production department; **Paul Wolff,** chief engineer of the company; **Grier D. Zimmerman**, chief engineer, Production department.

•

Oil and Gas Property Management, Inc., has announced the election of **C. C. (Mike) Harter, Jr.**, of Dallas as executive vice president; **Lee J. Thronson,** Dallas, vice president; and **Harry Leyendecker**, Houston, vice president. At a meeting of **The Dorchester Corporation,** which is owned 100 percent by Oil and Gas Property Management, Inc., **Glenn Eckel** of Amarillo, Texas, was elected a vice president of the corporation.

•

Harry H. Mack, manager for **Russell Maguire,** oil producer, in Wichita Falls, Texas, has joined Paine Drilling Company in Dallas. Before joining Russell Maguire, five years ago, Mack was vice president in charge of production for Sunray Oil Company.



WORTHINGTON POWER PUMP handles light hydrocarbons at Indiana refinery. Close-clearance liquid end makes this pump a natural for handling propane, butane, and other volatile fluids.

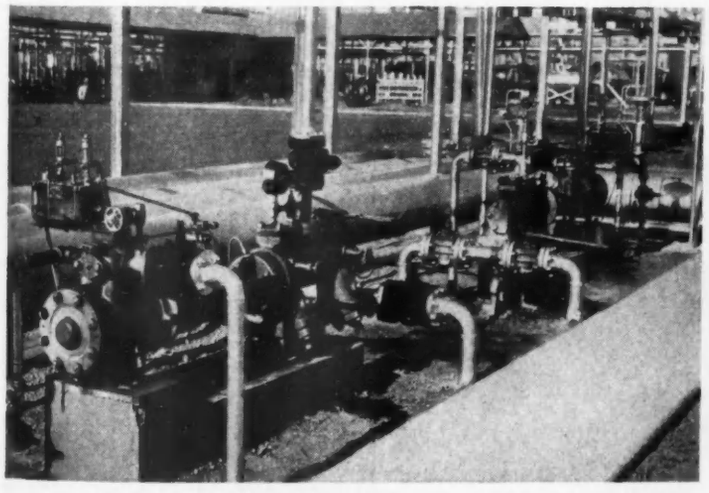
Power pump?
Steam pump?
Rotary pump?

You name it . . . we make it!

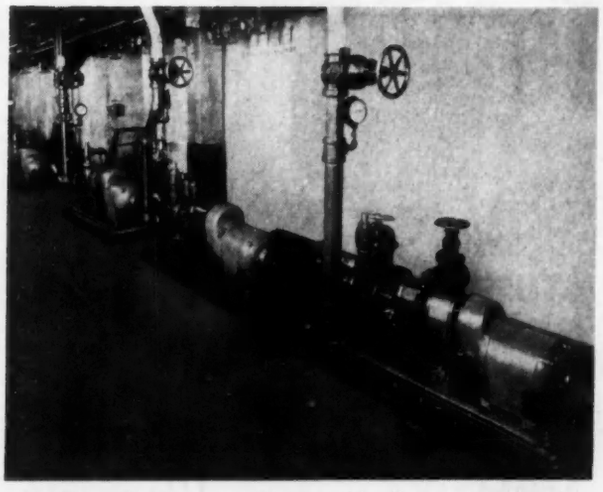
• When you're in the market for a pump, it stands to reason that you'll do better by going to a pump specialist. And that's exactly what Worthington has been since 1840.

Because we make all types of pumps–in thousands of different sizes—we're able to give an unbiased, objective opinion about any and all of your pump needs. No matter what your pressure requirements or type of power available, there's a Worthington pump that will suit your application exactly.

Write and tell us about your pumping problems. Be sure to give all pertinent details. Drop a line to your nearest Worthington district office or write directly to Worthington Corporation, Reciprocating Pump Division, Section P.3.2, Harrison, New Jersey. P.3.2



WORTHINGTON STEAM PUMPS pick up condensate from scrubbers for this petroleum company in Oklahoma. These units are part of Worthington's HiVol line—pumps specially designed to handle highly volatile liquids with high volumetric efficiency.



WORTHINGTON ROTARY PUMPS at this oil company plant in Pennsylvania are used for filling cans with motor oil of various viscosities. Every Worthington rotary pump is completely tested on oil before being put in stock.

SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street.

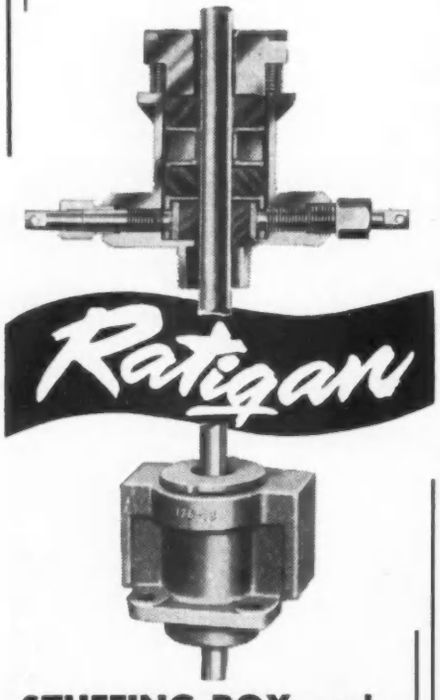
WORTHINGTON

MEMBER

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

Centrifugal • Rotary • Steam • Power • Vertical Turbine

Continuous
Lubrication
of
Polished Rod
KEEPS
Operating Costs
DOWN



STUFFING BOX and LUBRICATING CAP

The Ratigan self-oiling Stuffing Box lubricates the polished rod when the well is not heading, and the Ratigan Lubricating Cap lubricates the polished rod when the flow of oil in the tubing is retarded.

This continuous lubrication provides the polished rod with a permanent thin film of oil which assures smooth operation and eliminates scoring and undue wear of the packing in the stuffing box.

This Ratigan combination is made for 1⅛" and 1¼"; and 1½" polished rods.

SOLD THROUGH LEADING SUPPLY STORES

J. P. RATIGAN, Inc.
1213 Santa Fe Ave., Los Angeles 21
Export: National Supply Co., Inc., Export Div.
600 Fifth Ave., New York 20, N.Y.

DEATHS

Harry O. Heller, 64, former vice president of Southwestern Engraving Company and advertising manager of Reed Roller Bit Company for the past 20 years, died December 1 in Houston. A native of Fort Wayne, Ind., Heller was the second president of the Houston chapter of the National Industrial Advertisers Association.

Harry O. Heller

•

F. R. Kenney of Los Angeles died November 25. Kenney became president of the old Marland Oil Company of California in the 1920's. In Ponca City he and J. K. Cleary founded the Kenney-Cleary Oil Company, which was later absorbed by the old Marland Company. In later years he resigned as president of the Marland firm and went to the Kettleman Oil Corporation.

•

Frank M. Siebert, chief chemist for Gulf Oil Corporation's Houston Production division for many years, died in Houston November 23. One of his early significant accomplishments was that of developing a method of separating oil from an oil and water emulsion. He developed an electrical dehydration system and he pioneered in the development of drilling methods. With his associates, Dr. Siebert started a mud school in the Gulf laboratory in Houston.

•

Ray E. Miller, 59, advisor to the Petroleum Chemicals division of E. I. DuPont de Nemours Company, died November 17 in New York. He resided in Wilmington, Del.

•

Roy D. Red of Tulsa, independent oil operator, died November 18, after an extended illness. He was born in Abilene, Texas, and moved to Tulsa in 1920 where he was active as a drilling contractor and oil producer.

•

Charles Eugene Crawley, 70, former president of Sinclair Oil and Gas Company, died November 25 in New York. Crawley was president of the Sinclair firm in 1916, after it was organized by the late Harry Sinclair and had served in that capacity until moving to New York in about 1919. He was vice president and a director of Consolidated Oil Corporation until he resigned in 1940. In later years Crawley was affiliated with Merrill, Lynch, Pierce, Fenner and Beane, brokerage firm.

•

Ellis (Earl) E. Davis, 54, who pioneered in the development of portable oil drilling equipment, died November 10 in Houston. He was manager of the Production department, technical services division of Shell Oil Company in Houston, a position he held for the last two years. Davis had been with Shell 31 years.

Tripplehorn PARAFFIN SCRAPERS

Still the BEST ANSWER to Paraffin in Pumping Wells!

New Improvements:

1. New specially processed, cold-rolled, scale-free steel.
2. Latest heat treating with atmosphere controlled furnaces.
3. New design end forming.

These improvements have resulted in perfect Triple-Spiral Spring-tempered Scrapers.

OTHER ADVANTAGES:

- No Welding — installed at the well.
- SAVES TIME AND MONEY, CAN BE RE-USED on replacement rods.
- May be spaced for any stroke length.
- Will not slip if rod is stressed. Tested for 2350 lbs. grip.
- Now in use in EVERY PARAFFIN AREA.
- Sizes available for IMMEDIATE DELIVERY — TO FIT ⅝" to 1" rods in 2", 2½", and 3" tubing.

Conveniently packaged and easily identified!

DISTRIBUTED BY

Bethlehem, Bovaird, Continental, J & L, Mid-Continent, National, Oilwell, Republic, United, and Wilson Supply Co.

The TRIPPLEHORN CO.

Phone FE-3231
P. O. Box 6326 DALLAS, TEXAS

Carl F. Salzer, assistant to the vice president and comptroller of Gulf Oil Corporation, died November 5. He was associated with the company for 25 years.

•

Durand W. Rogers, toolpusher for Delta Drilling Company for 17 years, died in Tyler, Texas, November 15.

•

Philip H. Patchin, retired vice president and director of Standard Oil Company of California, died November 30 in San Mateo, Calif. Patchin retired from the company in 1943 after 24 years of service. He was a well known former newspaperman and had held several State Department assignments.

•

Robert Walter Miller, vice president and director of Creole Petroleum Corporation, died December 10 while on a business trip in London, England. Miller joined Standard Oil Company (N. J.) in 1919 and became export sales manager of Creole in 1944. He relinquished his position as export sales manager in 1953 to carry out his duties as vice president and director.

•

Burtner Fleeger, 67, president of Oklahome Steel Casting Company, died November 12. He was also an independent oil producer.

•

George W. Stage, 74, of Tulsa, died December 4. He was district landman for United Producing Company.

•

William J. Boyd, 50, area material supervisor at Kiefer, Okla., for Gulf Oil Corporation, died December 4. He had been with Gulf for 29 years.

•

Robert Grant David, 77, retired oil man, died in Bartlesville December 8. David was with Cities Service Oil Company and U. S. Bureau of Mines before his retirement.

•

Fred M. Furman, 75, general superintendent for J. G. Beard Estate Oil Company for the past 32 years, died December 2 at Judson, Texas.

•

F. J. Searight, 67, retired oil producer, died December 8 in Tulsa. He went to Tulsa in 1918 and was prominent in oil activities in Colorado, Kansas, Texas and Oklahoma.

•

Paul E. Hurley, 53, manager of Shell Oil Company's Houston refinery, died October 26 in New Orleans. He had been manager of Shell's Norco, La., refinery for the past nine years.

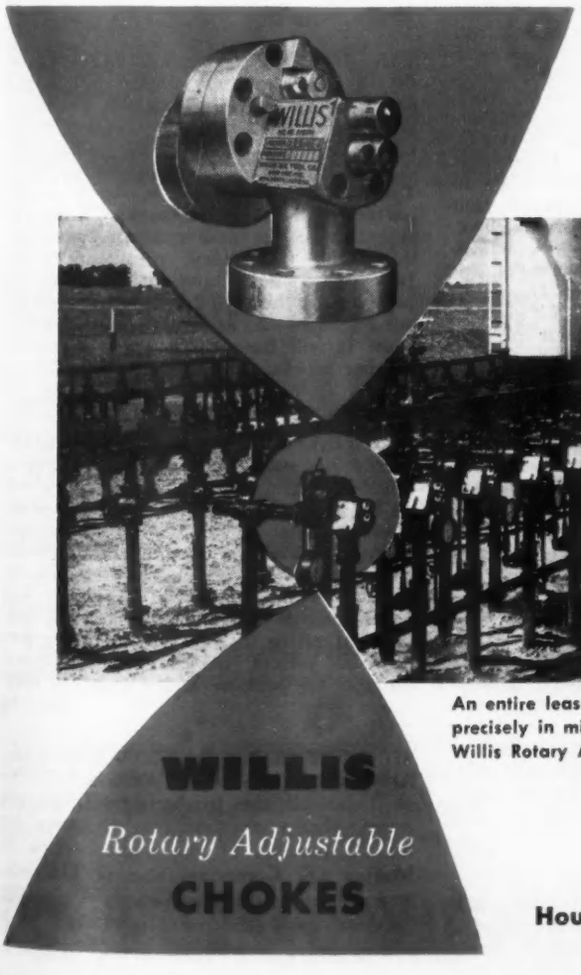
•

Dana H. Kelsey, 82, vice president of Sinclair Oil and Gas Company until his retirement in 1948, died October 26 in Garden Groves, Calif. He was a resident of Tulsa. Kelsey, who was honored as a "Grand Old Man" of the petroleum industry at the International Oil Show in Tulsa in 1948, was born at Versailles, Mo. After serving as superintendent for the Five Civilized Tribes at Muskogee, Okla., he joined the Sinclair interests and played an active part in that company's development.

ERRATUM

The fifth paragraph of the article on Page 222 of the December issue of World Oil, entitled "Pembina Field's Development Drilling Proves Successful," should have read "The discovery well at Pembina was drilled by the American-Canadian team of Seaboard Oil Company, the Honolulu Oil Corporation, Merrill Petroleums Ltd., and Cancoll Oil & Gas Ltd., the latter being the oil-operating unit of Canadian Collieries (Dunsmuir) Ltd., on farmout lands to Socony-Vacuum Oil Company of Canada Ltd.", instead of "on farmout lands from Socony-Vacuum Oil Company of Canada Ltd."

By drilling this discovery well, Socony-Vacuum earned a 50 percent interest in several Crown lands held by the American-Canadian team.



An entire lease is controlled accurately and precisely in minutes through this battery of Willis Rotary Adjustable Chokes.

6 ways better

flow control

PROVIDES 6 different sized choke inserts which are individually positioned in the line of flow by a fractional turn of the orifice-carrying disc . . . under constant flow and high pressure.

The 6 graduated orifices are changed to a new range in minutes...without shutting-in the well.

A positive shut-in is made by inserting a blank orifice.

WILLIS OIL TOOL COMPANY

3440 Pine Ave., Long Beach 7, California

Houston: 2012 Taft Street **Odessa: 100 N. Texas Street**

FIELD TESTED AND APPROVED

JET-LUBE APPLICATOR

For Applying Lubricants to Tool Joints, Drill Collars, Drill Tubing, Casings and Tubing

√ prevents contamination
√ reduces lube consumption
√ cleaner and safer
√ quicker round trips
√ increases service life
√ measured lubrication
√ drum off working floor

JET-LUBE APPLICATORS will pump any kind of lubricant which will seek its own level... which will not settle out under vibration... and which can be pumped at sub-zero temperatures.

JET-LUBE's "550", "21" and KOPR-KOTE meet all these requirements

Write for Technical Bulletins on Jet-Lube Applicator and Compounds

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Export Office
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Canadian Licensee
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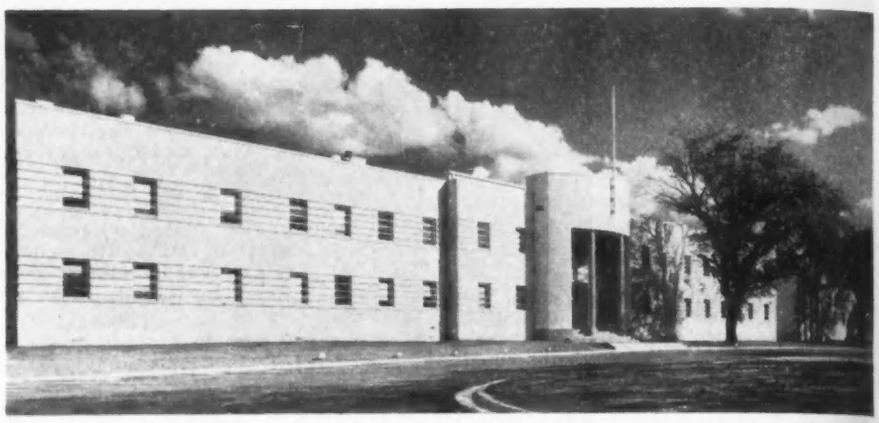
Companies in the News



Carter Enlarges Tulsa Research Facilities

More than 100 educators, scientists and petroleum industry leaders participated in ceremonies dedicating the opening of the enlarged research laboratory of The Carter Oil Company in Tulsa. The group toured the new Carter research facilities. Wallace E. Pratt, world famous geologist and former Jersey Standard vice president and director, climaxed the activities with an address. A new research building, containing 56 rooms and new scientific equipment, and a 90-foot high drilling research tower where actual drilling operations may be carried on as from a steel derrick, have increased the research facilities of Carter by 50 percent.

STANOLIND OIL AND GAS COMPANY has opened a new district production office in Casper. The office will serve a new district designated as the Casper district which will include producing operations in most of Colorado, western Nebraska, Utah, Idaho, South Dakota and most of Wyoming. **F. A. Gruver** has been named superintendent of the new district, with offices in Casper at 162 North Wolcott Street. Gruver was formerly field superintendent at Rangely, Colo. **M. O. Hegglund,** formerly senior petroleum engineer in the company's division office in Casper, was named district engineer, and **J. C. Hawkins** was made district clerk. Hawkins was formerly field clerk at Elk Basin. Other organizational changes announced by Larson were the establishment of two new area offices in the division. A new Kimball area, headquartered in Kimball, Neb., will supervise producing operations in western Nebraska and portions of Colorado and Wyoming. **V. M. Adams,** farm boss, will be in charge of operations. A new area office was also established at Dickinson, N. D., to serve a new area designated as the Dickinson area. This area will comprise North Dakota and part of Montana. **H. L. Howard,** production foreman, will be in charge of the Dickinson office.

•

SUN OIL COMPANY has announced the beginning of construction of a new production research and development laboratory and a service building. Site for the structures is northwest of the city limits of Richardson, Texas, and the estimated cost of the project is $400,000. The new structures will supplant Sun's present laboratory on Zangs Boulevard in the Oak Cliff section of Dallas.

•

CITIES SERVICE OIL COMPANY (DEL.) has announced construction of a five-story annex to the present Cities Service building in Bartlesville, Okla. Completion is expected for the middle of 1955. The Masonic Lodge of Bartlesville, owner of the present nine-story Cities Service building, will build the annex.

•

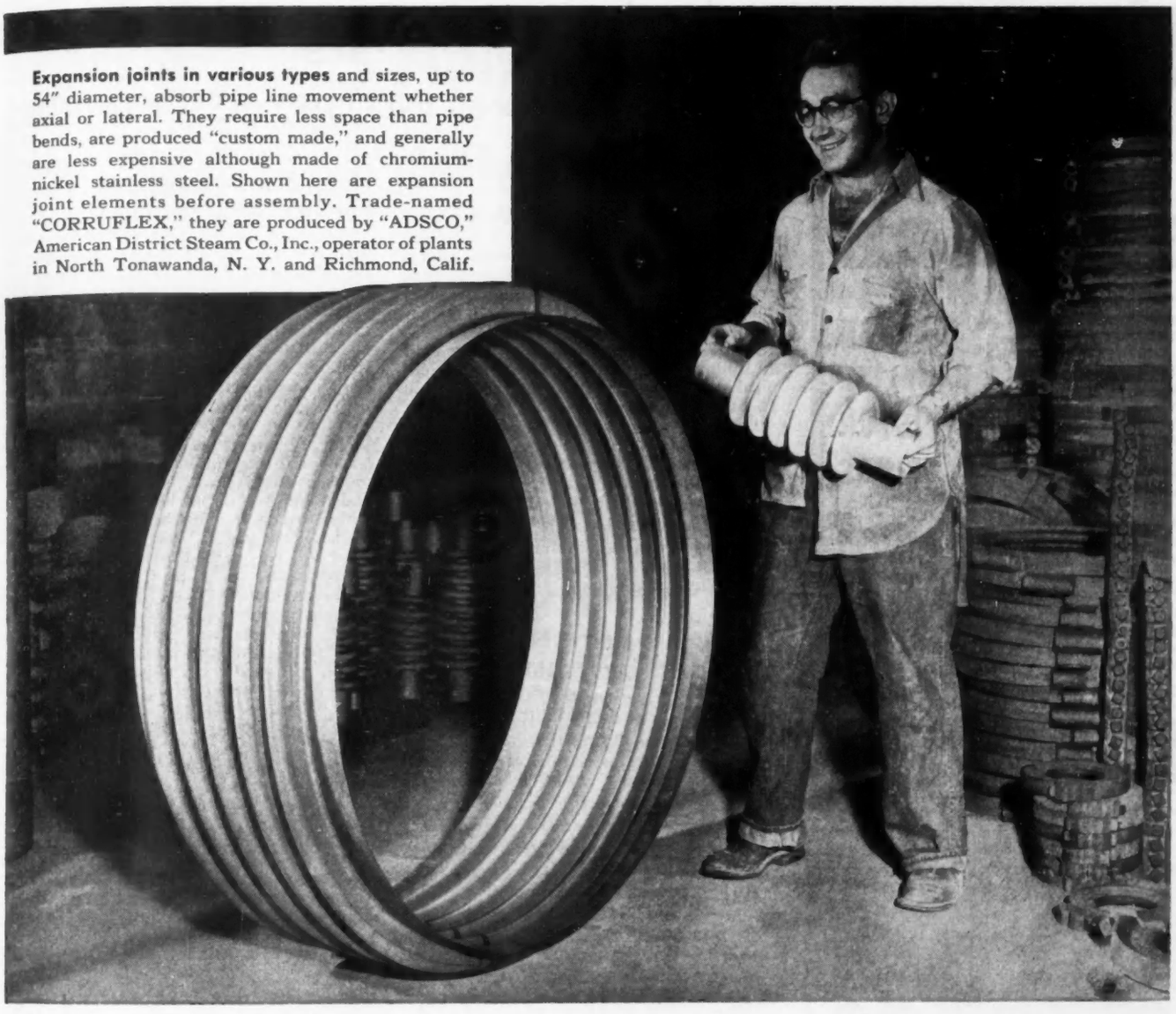
SAN JUAN EXPLORATION COMPANY of Dallas has entered into a contract to manage and operate Producing Properties, Inc., formed recently by the sale of securities to the public. The president of the latter company is **A. Knox Tyson** of Houston, who is also managing partner of Slick Oil Company, Ltd. The objective of the new company according to Robert J. Bradley, president of San Juan, is to make outright purchases for cash of producing oil and gas properties or corporations and for some time to come it will have no interest in wildcat drilling blocks.

•

STANOLIND OIL AND GAS COMPANY has established a new geophysical office at Shreveport, La. The office will be located in the Shelby Building where Stanolind also has a district exploration office for land and geological operations and a district production office. **D. W. Ratliffe,** field seismograph supervisor, will be in charge of the newly-created geophysical office as well as the other geophysical offices in Stanolind's Central division, in Jackson and Oklahoma City.

•

MURPHY CORPORATION of Eldorado, Ark., has acquired from William J. Sherry of Tulsa all the producing oil and gas leases Sherry received in exchange for his 62 percent of the capital stock in **Marine Oil Company,** also of Eldorado, at a recent partial liquidation. Marine Oil Company will continue to operate as a subsidiary of Murphy Corporation.



Expansion joints in various types and sizes, up to 54" diameter, absorb pipe line movement whether axial or lateral. They require less space than pipe bends, are produced "custom made," and generally are less expensive although made of chromium-nickel stainless steel. Shown here are expansion joint elements before assembly. Trade-named "CORRUFLEX," they are produced by "ADSCO," American District Steam Co., Inc., operator of plants in North Tonawanda, N. Y. and Richmond, Calif.

expansion joints that get STRONGER with use

INITIAL LOW COST is not the biggest advantage that stainless steel joints offer you . . .

Nor is it the outstanding resistance of chromium-nickel stainless to heat, to erosion and to corrosion . . .

The really great superiority of expansion joints made from Types 304, 316 and 317 stainless steel results from their action where piping movement must be controlled.

These joints minimize stresses and strains on pipe anchors . . . they minimize pressure thrust at anchor points.

The strength of austenitic chromium-nickel stainless steel increases when this metal is cold worked. With proper maintenance, joints of stainless steel containing nickel will last as long as the pipe line.

You can use chromium-nickel stainless steel for all sorts of applications. Not only for strength at temperatures that would destroy ordinary metals, but also for high impact values where temperatures fall as low as -300°F.

In addition, stainless steel containing nickel resists attacks from both organic and inorganic corrosive agents. It's one of the strongest, toughest, and most economical means for extending the life of vapor lines, bubble towers, reactors, and other vital equipment.

Investigate how stainless steel can save you money. Leading steel companies produce austenitic chromium-nickel stainless steel in all commercial forms. A list of sources of supply will be furnished upon your request. Write for it today.

INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

HIGH
Efficiency
with
FRANCE

You engineers know that a bakelite material, that can remain unchanged for *15 hours, under critical operating conditions, while competitive products under similar test conditions were destroyed, is a proved: highly effective material.

FRANCE CARBON-BAKELITE PISTON RINGS for your gas compressors will outlast any comparable material—no deterioration with age or use; not affected by wet or sour gases.

*Data on complete test available on request.

CARBON BAKELITE PISTON RINGS

Write for Complete Information

MAXIMUM SERVICE for you in our NEW PLANT

FRANCE PACKING COMPANY

9925 Bustleton Ave., Philadelphia 15, Pa.

PARAMOUNT
IMPROVED
STUFFING-BOX
SAFETY CLAMP

- SAFER
- MORE EFFICIENT
- LIGHTER
- SPRING ACTUATED

Tens-alloy aluminum clamp is self-supporting on the polished rod, can be tightened with one hand, helps prevent accidents.

Available in Six Sizes
Stocked at Leading Supply Stores

Paramount
EQUIPMENT CO., INC.
TULSA, OKLA.

What's Happening

AMONG INDUSTRY ASSOCIATIONS

Rocky Mountain AAPG Plans February Meeting

"Milestones and Guideposts in Exploration" will be stressed by technical papers on recent exploration and development programs in the Rocky Mountain area during the fifth annual meeting of the Rocky Mountain Section, American Association of Petroleum Geologists, to be held at Billings, Mont., February 14-16. Technical sessions will be held February 15 and 16 at the Fox Theater.

Governor J. Hugo Aronson of Montana will give the address of welcome and Dr. L. L. Sloss, Northwestern University, will keynote the sessions with a talk: "Prejudice, Progress and Promise in Rocky Mountain Oil Exploration." Following an address by John R. Fanshawe, consultant, and president of the section, technical papers will be presented.

3 Groups Name Officers At Pacific Coast Meeting

Results of election of officers for Pacific sections of the AAPG, SEG, and SEPM were announced during the thirty-first annual American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists were announced during the thirty-first annual joint meeting in Los Angeles in November.

AAPG officers are Frank S. Parker, Signal Oil and Gas Company, Los Angeles, president; Ben C. Lupton, General Petroleum Corporation, Los Angeles, vice president; Robert C. Kelly, Continental Oil Company, Los Angeles, secretary; and Louis J. Simon, The Texas Company, Los Angeles, treasurer.

J. W. Mathews, Richfield Oil Corporation, Bakersfield, is president of the SEG.

Other officers are Richard W. Shoemaker, Ohio Oil Company, Bakersfield, Northern district vice president; Ellsworth M. Curry, Shell Oil Company, Los Angeles, Southern district vice president; and L. I. Brockway, Western Gulf Oil Company, Bakersfield, secretary-treasurer.

SEPM named Harold G. Billman, Union Oil, Bakersfield, president and Edward H. Stinemeyer, Shell Oil, Bakersfield, secretary-treasurer of the group.

Permian Basin Corrosion Engineers Elect Officers

Results of elections of the Permian Basin Section of the National Association of Corrosion Engineers were announced recently at Odessa, Texas.

John Watts, Midland, Texas, Humble Pipeline Company, was named incoming Chairman. New officers include Jay Stafford, National Tank Company, first vice chairman; C. C. Michel, Cardinal Chemical, Inc., second vice chairman; Dr. A. A. Alberts, The Western Company, secretary; and Harold Winston, Gulf Oil Corporation, treasurer.

Hotel Plans Announced For 1955 API Meeting

Arrangements for making hotel reservations for the 1955 meeting of the American Petroleum Institute in San Francisco have been announced by the recently-appointed housing committee of the API.

All requests for hotel space should be made to the API Housing Bureau, Room 300, 61 Grove Street, San Francisco 2, Calif. Any requests sent direct to hotels will be referred to the bureau.

Dates for the meeting are November 14-17 and reservations should be made no later than May 1. On that date all requests received will be assigned to hotels and notice will be forwarded by the committee to each person informing him of his hotel assignment. After May 1 reservations will be handled on a first-come-first-served basis.

Meetings of the board of directors will be held in the Mark Hopkins Hotel and board members are advised to request space at one of the hotels on Nob Hill, where all parlor suites will be held for them in the Fairmont, Huntington, and Mark Hopkins hotels.

Group sessions and committee meetings are scheduled for the Mark Hopkins (Fundamental Research group session and committee meetings); the Fairmont (Public Relations group session, Transportation group sessions and committee meetings, and board of councillors); the St. Francis (Refining group session and Refining division committee meetings, Marketing division committee meetings and Marketing division headquarters, group sessions of the APIC, Lubrication and Statistics, and the Institute's Press headquarters); the Palace (Production group sessions and all Production division committee meetings and Production division headquarters; Financial and Accounting sessions and meetings, and Safety and Fire Protection committee meetings).

The two general sessions will be held in the Curran Theatre.

Gulf Coast Section SEPM Elects Stuckey President

Charles W. Stuckey, Jr., Union Oil Company of California, Houston, was elected president of the Gulf Coast Section of the Society of Economic Paleontologists and Mineralogists for 1955.

Other officers are E. H. Rainwater, Shell Oil Company, Jackson, Miss., vice president; W. H. Akers, The California Company, New Orleans, secretary; and Fred L. Smith, Jr., consultant, Houston, treasurer.

Chemical Society Plans Symposium in Houston

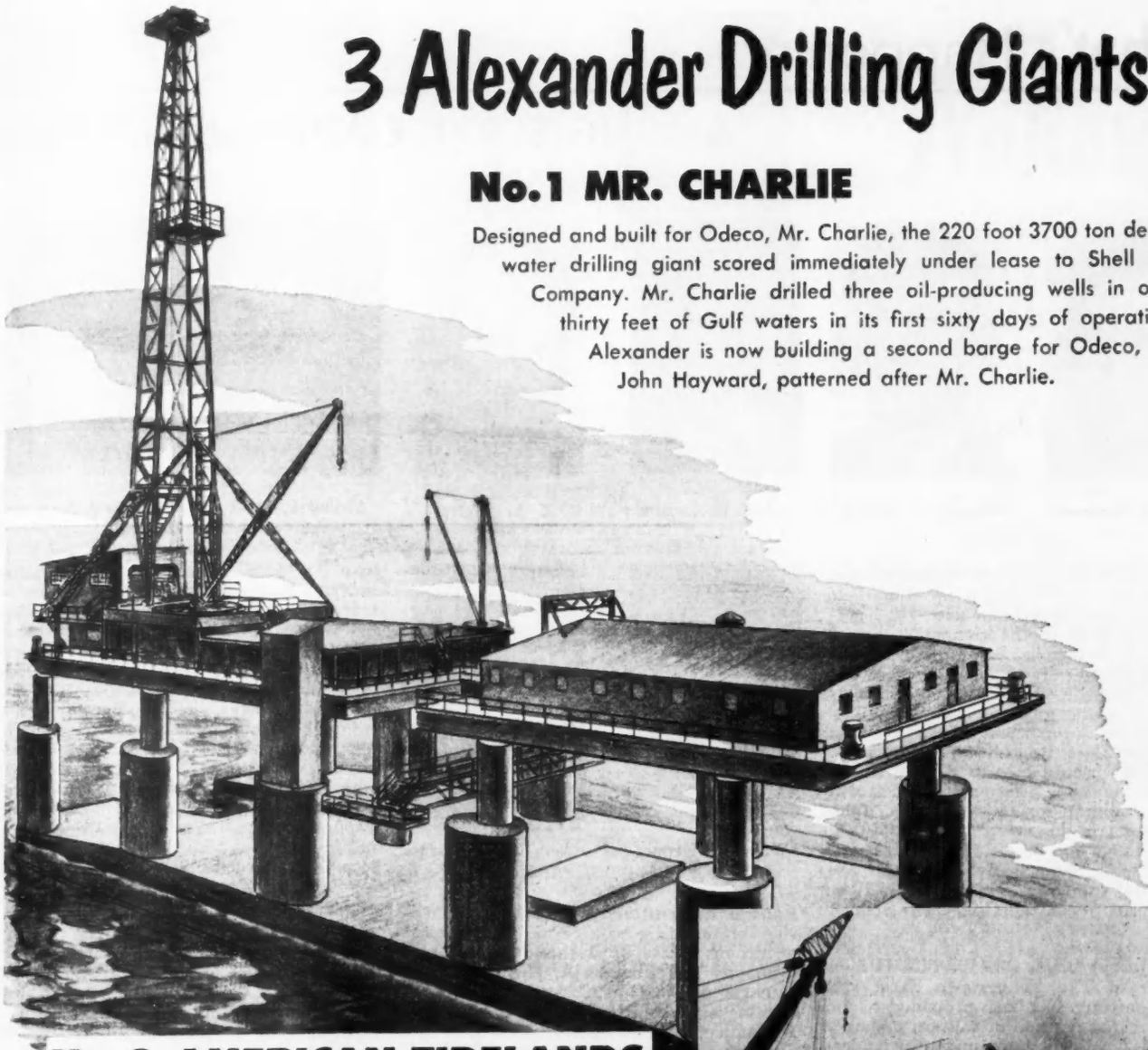
The Symposium on Hydrocarbon Chemistry, sponsored by Southeastern Texas Section, American Chemical Society, will be held in Houston January 27-28 at the Rice Hotel.

Registration begins at 5 p.m. January 26. Dinner speaker will be Carey Croneis, provost of Rice Institute and Harry C. Wiess, professor of geology, who will speak on "Mankind in Geological Perspective."

3 Alexander Drilling Giants!

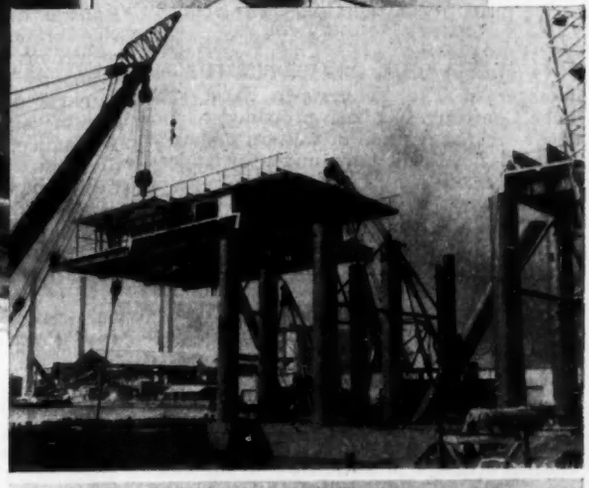
No. 1 MR. CHARLIE

Designed and built for Odeco, Mr. Charlie, the 220 foot 3700 ton deep-water drilling giant scored immediately under lease to Shell Oil Company. Mr. Charlie drilled three oil-producing wells in over thirty feet of Gulf waters in its first sixty days of operation! Alexander is now building a second barge for Odeco, the John Hayward, patterned after Mr. Charlie.



No. 2 AMERICAN TIDELANDS

The 380 ton lift (right) is the drilling end of Alexander's second current deep-water barge and is being built for American Tidelands, Inc. The barge is 200′ x 74′ x 92′ (from hull bottom to helicopter deck), drills in 45 feet of water and accommodates 40 men. Delivery — Dec. '54.



No. 3 JOHN HAYWARD

Alexander's second deep-water barge for Ocean Drilling and Exploration Company is the John Hayward, sister ship to Mr. Charlie. The John Hayward is 180′ x 120′ x 70′ (from hull bottom to helicopter deck.) It was launched in October, fifty days ahead of schedule and is slated for delivery early in '55.

ALEXANDER Shipyard INC.

P. O. Box 8126, New Orleans, La. VAlley 2408

DESIGNERS AND BUILDERS OF FINE MARINE EQUIPMENT

What's Happening

AMONG SERVICE AND SUPPLY MEN

William J. Brinkworth

James G. Samuell

Raleigh Hortenstine

R. A. Gentry

Walter L. Smith

John A. Morgan

William J. Brinkworth has been appointed manager of oil field sales for **Link-Belt Company**, a newly created post. His headquarters will be in the company's Ewart plant in Indianapolis. Brinkworth will be in charge of all sales of oil field equipment made at the Ewart plant to distributors and original equipment manufacturers. Formerly Brinkworth was head of oil field distributor sales in Houston. **James G. Samuell** has been named to succeed Brinkworth in Houston. Previously Samuell was a sales engineer for oil field sales. **John R. Sybesma** is the new Link-Belt district representative for oil field sales in Houston replacing Samuell. Sybesma, who was transferred from the Ewart plant, will be active primarily in the Gulf Coast area.

P. G. (Jerry) Boyd, Chicago district sales manager of **The Youngstown Sheet and Tube Company**, has been promoted to the newly-created position of western manager of sales. Boyd will have under his supervision the company's district sales offices in Chicago, Des Moines, Grand Rapids, Indianapolis, Kansas City, Milwaukee, Minneapolis and St. Louis. **C. Hix Jones**, Detroit district sales manager, will succeed Boyd and **David H. Goodfellow**, assistant Detroit district sales manager, will succeed Jones as Detroit manager.

John M. Tuthill, assistant general manager of sales for **The Youngstown Sheet and Tube Company**, has been appointed general manager of sales. Now in the Chicago office, Tuthill will transfer to the main office in Youngstown. **John P. DeHetre**, appointed assistant general manager of sales last June, will be transferred to Chicago to succeed Tuthill. Tuthill joined the firm as assistant manager of flat rolled sales in 1935 and was promoted to manager in 1952. He was appointed assistant general manager of sales in 1952. DeHetre joined the company in 1938 as an assistant field engineer in Los Angeles. He was promoted to manager of oil country tubular sales in 1949.

Phil L. Lynn, field representative for **U. S. Steel's Oil Well Supply Division**, was transferred from Cushing, Okla., to Lindsay. Lynn, who joined Oilwell in 1950, was promoted to field representative at Cushing in 1954.

Warren B. Hermes

John D. Nicholson

Raleigh Hortenstine, Jr. has been named vice president in charge of Gulf Coast operations for **The Continental Supply Company** and **Richard A. Gentry** is new manager of the Gulf Coast division. Hortenstine assumes the duties of the late **N. A. Endicott**, while Gentry takes over the division manager position formerly held by Hortenstine. Hortenstine joined the company in 1934, starting in the Dallas headquarters. He became division manager in 1952. Gentry, who started with Continental in 1936, moved up to district credit manager in Shreveport, La., and in 1950 became division credit manager of the Gulf Coast division.

Warren B. Hermes has joined **Maintenance Engineering** in Houston as sales engineer. Hermes was with Brown and Root four years doing instrumentation, drafting, and field instrument engineering. He will devote his time to the Masonellan and Smith Meter Sales Division.

John D. Nicholson has been appointed sales manager of **Southern Engine & Pump Company.** Nicholson began as sales engineer with the firm in 1948 after gaining experience in refineries.

Bill Lohman is promoted by **Fluid Packed Pump Company** to Oklahoma district manager. His headquarters will be in Oklahoma City and he will assist **G. R. Newbolt** in supervising oilmaster pump sales and service. Lohman joined Fluid Packed Pump Company's sales force at Odessa in 1947 and was transferred to Seminole in 1952.

John A. Morgan has been named to the newly-created post of executive vice president of **Butler Manufacturing Company** and **Walter L. Smith** has been elected vice president—engineering and production. Morgan, who has been with the firm for 15 years, has served as assistant to the general manager, advertising and sales promotion manager, assistant general manager, and general manager. He was elected to the board of directors in 1952. Smith joined Butler in 1934 as a product engineer in the Stoker division. He progressed through various enginering responsibilities and in 1939 was named chief engineer. He became a board member in 1947 and was appointed chief production manager.

W. Q. Mitchell has been promoted to store manager of **Bethlehem Supply Company's** Shreveport, La., store. Mitchell has been with Bethlehem for 24 years and has had experience in the oil field supply business of East Texas and northern Louisiana. Mitchell was store manager at Winnsboro for five years before transferring to Shreveport in 1953 as assistant store manager of the store there.

H. D. Garbett has been promoted to store manager of the **Bethlehem Supply Company** store in Winnsboro, Texas. Garbett has been employed by Bethlehem since 1939 and most recently was special representative in the Shreveport, La., area. **H. B. Carroll, Jr.**, will be field representative at the Winnsboro store. **W. C. Sheehan** has been promoted to field representative in the Kermit, Texas, store. Sheehan formerly was a floorman at Sundown, Texas, and more recently a clerk in the Kermit store.

Louis Paul Smith, vice president and plant manager in Ithaca, N. Y., for **Borg-Warner Corporation**, has been named vice president of manufacturing operations of the company. **M. V. Bailliere**, formerly controller and assistant secretary at Ithaca, has been made responsible for all finances of the company. **Norman C. Bremer**, previously chief engineer at Ithaca, takes on additional duties of chief engineer at the Detroit plant. **James V. Davis** adds the Detroit plant to his responsibilities as industrial relations manager.

John H. Sheusner

L. D. Carver

E. C. (Gene) McCann

W. G. McDaniel

John H. Sheusner has been appointed manager of operations of the Enterprise division of **General Metals Corporation.** Sheusner has been associated with Enterprise since February, 1954. In his new post he will have charge of all engine research, development and engineering activities with manufacturing in all its phases.

Leslie D. Carver is now export technical sales manager for **Witco Chemical Company** and **Continental Carbon Company.** Carver has been technical service director, Rubber Chemicals division, since joining the Witco-Continental organization in January, 1948. He has represented the organization in the United Kingdom and Europe.

G. F. Ryan has been appointed sales manager of the New York district for **Leschen Wire Rope Division, H. K. Porter Company, Inc.** Ryan will be in charge of Leschen sales activities in New York, New England, New Jersey, Maryland and eastern Pennsylvania.

Dr. George L. Royer has been named administrative assistant to the general manager of **American Cyanamid Company's** Research Division. He will coordinate policies on budgets, personnel and publications at the division's laboratories in Stamford, Conn., Pearl River, N. Y., and Bound Brook, N. J.

G. Allen Lovell has been appointed assistant general manager of the mechanical goods division, U. S. Rubber Company, replacing **Herbert G. Kieswetter,** who is named executive assistant to the general manager of the company's international division. Kieswetter will supervise activities of the international division in Great Britain and Europe, including relations with affiliated and associated companies and with the sales organization and customers of the division in that area. Lovell will have responsibility for supervising production and research as well as sales operations in the mechanical goods division.

Paul A. Manor, a design engineer with Surface Combustion Corporation at Columbus, has been named chief engineer of **Rockwell Manufacturing Company's** lubricated plug valve plant at Barberton, Ohio. He joined Surface Combustion in 1931 and worked at the Toledo plant for seven years before being transferred to Columbus.

J. E. (Gene) Haynes has been appointed assistant district manager of the Pampa District of **Welex Jet Services, Inc.** Haynes worked for Welex 2½ years and was employed as a sales engineer prior to this promotion. Prior to his Welex employment, Haynes had several years' experience in the oil field.

E. C. (Gene) McCann has been named Louisiana-Mississippi sales engineer for **Rockwell** built Mudwonder mudline valves. McCann formerly worked for Delta Supply Company in Houma, La.; for Technical Oil Tool Corporation, Lafayette, as a field engineer; and for Houston Oilfield Material Company, as a mud engineer.

William G. McDaniel, formerly a sales engineer with **The Foxboro Company** branch office in Houston, has been appointed manager of the company's branch in Corpus Christi, Texas. McDaniel replaces **W. A. Rock,** who recently joined the firm of Schultz y Cia., S. A., Foxboro representative in Mexico.

E. C. Beaumont, Lane-Wells station superintendent at Opelousas, La., has been transferred to Natchez, Miss. He is replacing **J. C. Strickland,** formerly in Natchez, who is moving to Opelousas as station superintendent.

Walter F. Klump, in charge of the Chicago district purchasing office for **The Youngstown Sheet and Tube Company,** retired November 30 after 36 years of service. He is succeded by **Robert H. Kelly,** who has been with the company's Purchasing department at Youngstown for 18 years. He will have the title of assistant purchasing agent in charge of the Chicago purchasing office.

Harrison H. Hance has been named to take charge of advertising and publications for **Kaiser Steel Corporation.** Hance comes to Kaiser Steel after six years with Kaiser Services, last serving as assistant to the manager, public relations and advertising. Before 1948 he was with Tide Water Associated Oil Company.

J. S. Besser, manager of fuel sales for **The Colorado Fuel and Iron Corporation,** has been elected director of the National Coal Association. He served 10 years as president of the Colorado-New Mexico Coal Operators Association.

Frank L. Mill of Tulsa has been appointed representative in the Mid-Continent area for **Murray Rubber Company** of Houston. Mill attended Rice Institute in Houston and since his graduation, he has devoted his time to the sale of oil industry equipment. For the past four years Mill has worked in the Mid-Continent area of Oklahoma, Kansas, and parts of Texas and Missouri.

W. T. Kyle has been appointed Pittsburgh district sales manager for the Wire Rope divisions of **American Chain & Cable Company, Inc.** Kyle's headquarters will be in Pittsburgh and will supervise sales in West Virginia, Ohio, western Pennsylvania and Kentucky.

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HOTEL EDSON ..... Beaumont
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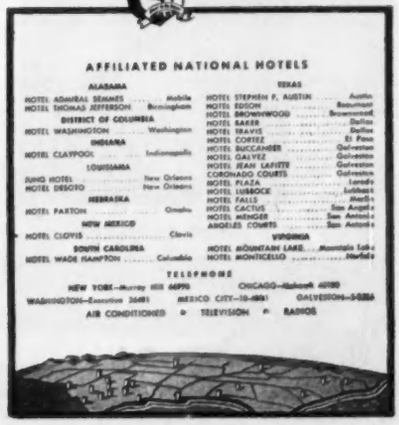


John A. Robertshaw has been elected president of **Robertshaw-Fulton Controls (Canada) Limited**, recently-formed subsidiary of Robertshaw-Fulton Controls Company. **George A. Elliott** was named vice president and general manager; **Walter H. Steffler,** secretary and treasurer; and **B. D. Taylor,** comptroller; and **H. William Biggar,** assistant secretary and assistant treasurer. Robertshaw, Steffler and Taylor hold similar positions with the parent firm, Robertshaw-Fulton Controls Company.

J. W. Jillson has been promoted to machinery sales representative for the Oklahoma district of **Bethlehem Supply Company.** He has been with Bethlehem since 1947 in the West Texas-New Mexico area and since January, 1953 has been local representative in the Oklahoma City district sales office. **J. A. Buland** has been promoted to local representative in Oklahoma City district sales office replacing Jillson. In addition **J. W. Strickland** has been transferred to Fort Morgan, Colo., as field representative and will operate a substore in conjunction with the Sterling, Colo. store.

Carl J. Minnig, for many years a vice president of **Witco Chemical Company,** has retired from the company but is being retained as a consultant and will continue to be available to his customers in the rubber industry. He will maintain his headquarters at the Akron office of Witco.

Paul L. Brooks, assistant to the vice president of **Parkersburg Rig & Reel Division** of **Parkersburg-Aetna Corporation,** has retired after 38 years with the company. Brooks will continue his association with the company in a consulting capacity and as special sales representative for Parkersburg products. Brooks worked his way up from office boy to various positions including sales manager, manager of the Southern division and Pacific Coast Manager.

Paul L. Brooks

R. S. Amend has been transferred by **Willis Oil Tool Company** from the factory at Long Beach, Calif., to the Houston branch as assistant to **Robert F. Benda,** Gulf Coast district manager. Amend will specialize in field engineering application and service from the office at Houston where Willis maintains warehouse stocks.

R. S. Amend

Nelson A. (Casey) Jones has been appointed Mid-West division manager of **Catawissa Valve & Fittings Company.** He will represent the company in the oil fields from headquarters at Irving, Texas. Jones has been with the company for 15 years, the last 12 as production manager at the Catawissa plant.

Marcus Cantrell has been appointed to the San Antonio, Texas, sales staff of **Southern Engine & Pump Company.**

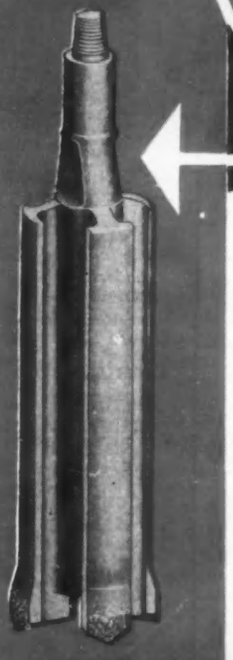
Edward J. Goett, formerly director of the Commercial Development department for **Atlas Powder Company,** has been elected a new vice president and director. He will be in charge of the company's Chemicals, Darco and Commercial Development departments. **Kenneth E. Mulford,** formerly general manager of the Chemicals department, has been named assistant to Goett.

W. Clayton Lytle, general manager of the Explosives department, is the new general manager of the Chemicals department. **Max E. Colson,** formerly director of operations of the Explosives department, is now general manager of that department. **Willis E. Collins, Jr.,** formerly director of explosives sales, has been named assistant general manager of the Explosives department. The new sales director is **George W. Thompson,** formerly assistant to Collins. **Harry L. Moat** was named director of explosives production.

Robert W. Southard has been appointed director of personnel for **Vapor Heating Corporation** and its manufacturing subsidiary, Roth Manufacturing Company. Both companies are located in a new plant completed this year. Before coming with Vapor Heating Corporation, Southard was director of personnel for Infilco Corporation of Chicago and Tucson, Ariz. He also worked in the Industrial Relations department for Republic Steel Corporation.

DRILL LARGE DIAMETER HOLES THE MODERN WAY . . . WITH

SPANG FABRICATED STAR BITS



Progressive Operators Everywhere Are Discovering This Modern, Better Way Of Drilling Large Diameter Holes.

SPANG FABRICATED STAR BITS replace the conventional, old-style spudding bit and the big hole paddle-type bit. They are made in large diameters for drilling hard formations, and can be dressed, ready for drilling, by hard surfacing quickly and economically, thereby saving the time consumed heating and ramming. Made in a variety of diameters, lengths and weights, with any size joint desired, SPANG Fabricated STAR BITS are your assurance of profitable **big hole** drilling.

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SPANG PILOT-TYPE REAMER BITS ARE RECOMMENDED

Field performance has amply proved these bits to be the driller's answer to **large hole** problems. They are made special, to your specifications and design, in any diameter; size and weight limited only by the handling capacity of conventional drilling rigs. They can be furnished to run on drilling stem or with integral rope socket top.

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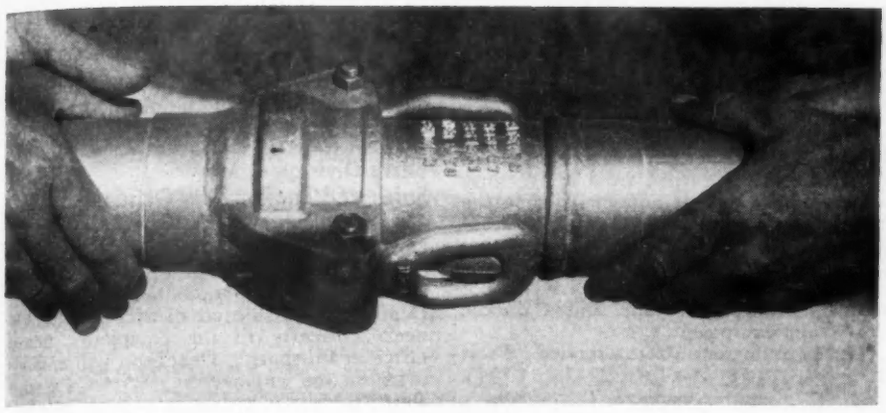
For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Water Wells, Prospect Drilling and Shot Blast Holes.



ALUMINUM PIPE is being used in oil industry installations for temporary oil, gas and water lines. The new development is based on the use of seamless pipe with a special coupling. Pictured here is the pipe after coupling has been latched in place. A split "O" ring gasket inside the coupling seals in place, creating a non-leak coupling.

Aluminum Pipe Tested For Oil Industry Uses

Aluminum pipe manufactured by Reynolds Metals Company is now being installed for temporary oil, gas and water lines and similar uses in the oil industry. Field tests show that the lines make possible sizable savings in rig time, transportation and handling of pipe, laying and picking up lines, and other cost factors. The new development is based upon use of seamless, extruded aluminum pipe, weighing less than one-eighth as much as steel pipe of comparable dimensions, with a special quick coupling.

A field demonstration of laying the aluminum pipe for a temporary gas line to a drilling site was given recently near Houston. The aluminum pipe for the installation was from Associated Oil Field Rentals, a Houston firm which is purchasing an initial shipment of approximately 45 miles of the pipe from Race & Race, a Winterhaven, Fla., firm which developed the special coupling used.

Reynolds Metals furnishes the seamless, extruded pipe to Race & Race and other firms which add their own coupling devices for quick installation and removal of the temporary lines. The coupling contains a split "O" ring gasket on the inside, which seals when the coupling is latched in place.

In actual installations 2⅞-inch aluminum pipe has been installed and picked up about ten times as fast as steel pipe of comparable dimensions. A mile of the aluminum pipe was recently handled by three men and one truck. Average stringing and coupling time was 1½ hours and average uncoupling and loading time was also 1½ hours. Total man hours were nine hours and total truck time three hours.

Savings are said to result principally from lighter weight and speed in coupling and uncoupling. A 30-foot joint of the aluminum pipe weights about 30 pounds; 30 feet of steel pipe of comparable dimensions weighs more than 200 pounds. Other advantages are rig time saved, increased volume of fluid, fast coupling with no thread maintenance and lower hauling cost.

Associated Rentals stocks the pipe in its field yards over the southwest and sells or rents the pipe installed in place.

Pelton Water Wheel Company Has New Odessa Headquarters

Pelton Water Wheel Company at Los Angeles has announced that Peltons' sales-service facility in Odessa, Texas, has moved to a new location at 421 Grandview Street. H. E. (Gene) Bell will continue to be in charge of the Odessa office and warehouse where a complete stock of spare parts is maintained and 24-hour service available. This facility, as well as Pelton's sales-service facility in Hobbs, N. M., is headed by Clyde Lietzow out of Odessa.

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McKISSICK BUILDS A BETTER BLOCK FOR EVERY PURPOSE
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Mc KISSICK
"HEAVY DUTY"
SNATCH BLOCK
All steel construction with 6"-8"-10" diameter steel sheaves, 2" diameter center pins.
Drop Forged steel swivel hooks, yokes, or shackles. Quickly interchangeable.
High speed bronze bushings or Hy-Load roller bearings.
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National Supply Has New Store At Drayton Valley, Canada

The National Supply Company, Ltd., has opened an oil well supply store at Drayton Valley, Alberta, Canada, to serve drillers and producers in the area.

The store will be the fifth operated by the company in Alberta, the others being at Calgary, Edmonton, Redwater, and Stettler. The company also has stores at Virden, Manitoba, and Swift Current and Weyburn, Saskatchewan.

Stanley R. Hill has been appointed manager of the store. It is under the supervision of A. Douglas Foulds, district manager.

PLICO Appoints Frost Company As Representative in 4 States

Pipeline Coating and Engineering Company recently appointed Frost Engineering Service Company, Los Angeles, as distributor for southern California, Arizona, New Mexico and southern Nevada. E. Vernon Frost, recently returned from active duty in the U. S. Navy, is now engaged in the engineering and sales of all PLICO products which include pipe line insulating spacers and casing end seals, poly-mastic cold-applied coating and PLICO hot enamel, primer and tape and Cathodic Protection equipment.

Upon returning from service, Frost formed Frost Engineering Service Company which will engage in the engineering and sales of equipment for the pipe line, production, natural gasoline and refinery departments of the oil industry and the natural gas industry.

Berry Division Opens Sales and Engineering Office

Berry Division of Oliver Iron and Steel Corporation has announced the opening of new sales and engineering offices in Chicago, and the appointment of W. L. Denniston as Chicago district sales engineer. Formerly in the company's home office in Pittsburgh, Denniston will engage in sales and engineering services for the Berry division's hydraulic pumps, motors, controls and transmissions.

Oil Well Supply to Handle Tubular Goods at Barge Terminals

Oil Well Supply Division of United States Steel has announced that it is arranging to carry selected stocks of oil-country tubular goods in "in-transit" storage at selected barge terminals. The price for carload quantities of such oil-country tubular goods handled through these terminals and loaded on trucks or cars at these terminals will be the "at-mill" carload price published by National Tube Division of United States Steel Corporation plus the 500-ton barge rate from shipping point to the barge terminal (including applicable insurance and taxes), plus four per cent of the "at-mill" carload price published by National Tube division.

The consumer delivered price for carload quantities of oil-country tubular goods handled through these selected barge terminals will be the above price, plus published rail or truck freight rates from barge terminal to destination.

New Lane-Wells Branch Opened in California

Lane-Wells Company has opened a new branch in Woodland, Calif., to serve increasing needs of the South Sacramento Valley Field.

The office is under the direction of Joseph L. Newman, Elwood B. Harris and Paul D. Knox. The new branch is equipped to provide perforating service and well logging service on the usual 24-hour a day basis.

Cochrane Corporation Opens District Sales Office

The Cochrane Corporation, manufacturers of water-conditioning equipment and steam specialties, announces the opening of its New York district sales office at 261 Madison Avenue, New York City.

Joseph R. Denton has been appointed manager of the new office. Denton is a graduate chemical engineer from Georgia Tech and has been formerly associated with Calco Chemical Division of American Cyanamid Company, and for the past 14 years, with the Worthington Corporation.

Goodall and Whitehead Rubber Companies Merge

A recent vote of the stockholders of Goodall Rubber Company and its subsidiary, Whitehead Bros. Rubber Company, both of Trenton, N. J., authorized the merger of the two companies, with Goodall serving as the parent organization.

Effective January 1, 1955, Whitehead Bros. Rubber Company will be identified as the Whitehead Rubber Division of Goodall Rubber Company.

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Wire Line Stripper (Auto-Releasing)

POSITIVE LATCH
will not release by accident or surge of pressure
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eliminate hazard of fire from this tool
SURE RELEASE MECHANISM
operated by rope socket striking bottom of stripper
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makes for easier handling at all times.

These wire line strippers represent an outstanding advance in design and construction of tools in this class.
Sometimes referred to as "wipers" or "oil savers," they provide the oil industry many advantages that were not previously available.

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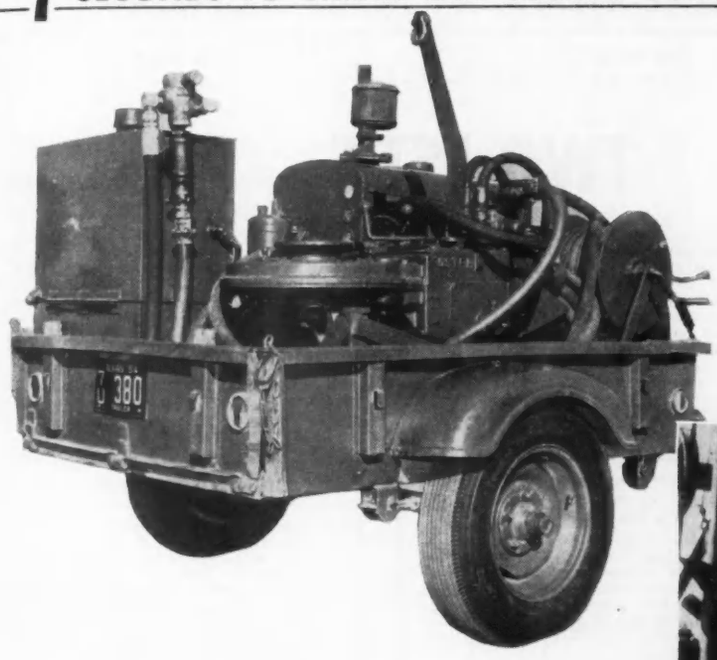
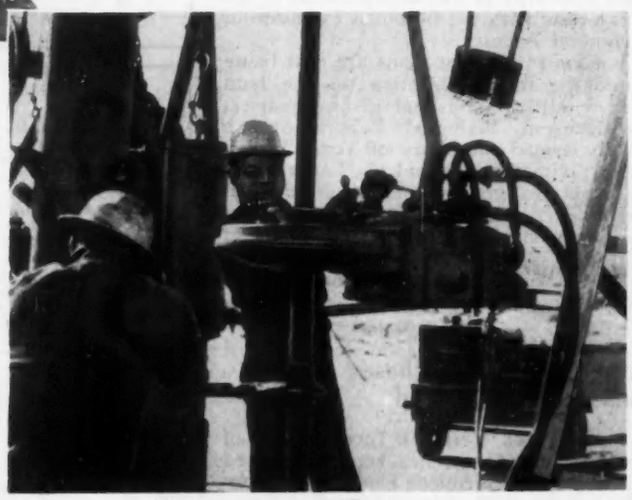
Foster TRAILER MOUNTED HYDRAULIC TUBING TONG

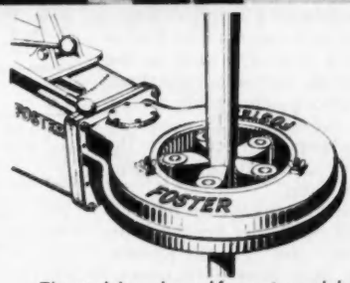
7 SECONDS TO BREAK OUT TUBING JOINT — 5 SECONDS TO MAKE UP JOINT



- **FAST . . . STAYS ON PIPE STRING FOR ENTIRE TRIP**
- **TAKES FATIGUING LABOR OUT OF JOINT BREAKING**
- **INCREASES PROFIT BY INCREASING AMOUNT OF WORK CREW CAN DO IN A DAY**
- **SAFER, ALL MOVING PARTS ENCLOSED**



The Foster Tubing Tong is the product of years of designing, experimenting, and testing . . . and offers revolutionary advantages. It is counter-balanced when installed and is easily moved up and down to permit the unlatching of the elevators — it need never be removed from the string of tubing. Two speeds are provided, and may be shifted smoothly at full speed with friction clutch. A continuous torque indication protects the tubing threads. Five gripping dogs grip the pipe without damage. The dogs disengage instantly from the tubing when the hydraulic motor is reversed. Fully portable trailer mount enables shuttling the complete equipment from location to location. The Foster Tubing Tong is a compact assembly of rugged, clean cut parts, assembled with such simplicity that years of trouble-free operation may be expected. Write for details.



The tubing is self centered by five gripping dogs. The dogs are mounted on a floating ring and are tightened uniformly by the ring gear.

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Northern Well Equipment Co.	Tioga, North Dakota
Texas Warehouse Service	Corpus Christi, Texas
R. D. Cloninger	Lafayette, Louisiana
Rotary Sales & Service, Ltd.	Edmonton, Alberta, Canada
W. O. Nelson	Farmington, New Mexico
Longley Y. Cia., S.R.L., (Ken Langley)	Buenos Aires
L. W. Mauck	Great Bend, Kansas
Joe Perry	Salem, Illinois

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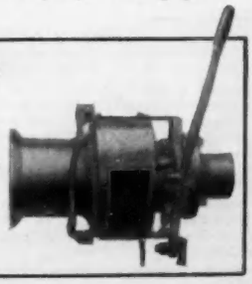
A Foster CATHEAD for Every Need



Edwin C. Anderson Company Named Factory Representative

Marine Products Company announces the appointment of Edwin C. Anderson Co., Denver, as factory representative for Colorado and adjoining states.

Edwin C. Anderson

Edwin C. Anderson has been associated with the pump business for over 18 years and is a graduate mechanical engineer. With his son, Bruce, who is soon to return from serving in the Armed Forces, they will offer sales and engineering service for Marine Products line of MP straight centrifugal Duraflex rotary, and Flomax self-priming centrifugal pumps.

Houston Technical Laboratories To Have Plant in Houston

J. E. Jonsson, president of Texas Instruments Incorporated, Dallas, has announced that Texas Instruments has purchased six acres of land in Houston. The tract is located on Buffalo Speedway at the intersection with the proposed extension of Richmond Avenue.

Jonsson stated that plans are now being considered for construction on the land of a new plant and general headquarters for Houston Technical Laboratories, a wholly owned subsidiary of Texas Instruments. Houston Technical Laboratories manufactures gravity meters, geophysical instruments and optical components for the petroleum industry. Its present plant is at 2424 Branard Street, Houston.

Robert W. Olson is president of Houston Technical Laboratories.

Dow Chemical Purchases Versenes Incorporated

Purchase of Versenes Incorporated of Framingham, Mass., has been announced by The Dow Chemical Company. Formerly known as Bersworth Chemical Company, Versenes has been engaged in manufacturing a group of products used in the detergent, soap, textile, metal, agricultural, rubber, pharmaceutical, chemical, petroleum and related industries. These products, known as chelating agents, have the ability to selectively inactivate or combine with various metal ions.

Dr. F. C. Bersworth, president of Versenes Incorporated, will become a Dow research consultant, and Frank Kottek, Versenes treasurer and general manager, will continue as production manager at Framingham where manufacturing operations will be maintained.

HELP WANTED

■ Assistant sales manager. The man we are seeking should be a young man with a successful oil country sales background; be able to work with our field sales staff and at the same time have sufficient executive capabilities to merit a place of responsibility in a well established and growing company serving the midcontinent oil fields from Houston headquarters. Replies strictly confidential. Our personnel know of this advertisement. Address Box 55-W, c/o WORLD OIL, Houston, Texas.

WORLD OIL'S Trading Post CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted ads**, 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 17th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

FOR SALE **FOR SALE**

FOR SALE **TWO LST'S** **UNCONVERTED**

Original numbers 739 & 793 stored Lake Charles, La. Also, all or part of unused conversion equipment consisting of 40—Lake Shore type SWB Model 11 winches, motors & controls; 40 Cargo booms, cast steel boomsteps & topping lift swivel; 2—Superior Gen. Sets Model GBD-8; 2—Capstan windlass with motor & controls; 24—Fassler kingposts 28" OD seamless steel pipe; 6—Buffalo axial flow exhaust fans motors & controls; 2—Hyde electric deck type gypsy windlass. No options will be granted. **Burrus Mills, Incorporated will not pay nor be responsible for payment of any commissions in connection with sale of these ships or equipment.** Sale is "as is." Terms cash within 15 days from acceptance of bid. **Burrus Mills, Incorporated reserves the right to reject any and all bids.** Bids will be opened 10:00 A.M. February 10, 1955. To arrange inspection and secure bid forms, contact Mr. R. D. Zumwalt, Vice-President Burrus Mills, Incorporated or Mr. A. M. Scott, Telephone PRospect 1881, Dallas, Texas.

GASOLINE PLANT FOR SALE

Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Adequate storage tanks for all products. Drum Lead Blending Plant. Detailed inventory available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Ft. Worth, Texas

■ FOR SALE: Truck mounted seismograph instruments of modern design, built by Southwestern Industrial Electronic Company, with multiple geophones and Vector Cable—shooting truck with Griffin body complete with loadingpoles and blaster — Metal dynamite magazin e trailer — Field office equipment — Also Power reel, Vector cable with 12 geophones for Marine operation. Box 52-W, WORLD OIL, Houston, Texas.

HELP WANTED

■ GRADUATE ENGINEER OR GEOLOGIST: At least five years experience with cable tool and rotary drilling methods and Turbine pumps—To design and **SELL** and supervise construction of water wells in Minn., N.D., S.D., Mont., Wisc., Iowa for industry and municipalities. Salary plus profit sharing. Give all experience and references in detail in first letter. All replies held strictly confidential. McCARTHY WELL COMPANY, 670 Eustis St., St. Paul, Minn. NATION'S OLDEST AND N.W's LARGEST SINCE 1860.

■ Petroleum Engineer under 35, drilling and production work, Rocky Mountain area, with compact but enterprising operator, excellent financial structure. Salary dependent upon experience and qualifications. Send detailed experience record. Box 51-W, c/o WORLD OIL, Houston, Texas.

POSITION WANTED

■ Landman-Geologist, desires retainer in Houston. Experienced all phases of leasing, drilling deals, farmouts, promotional work in Gulf Coast. Young, energetic, ambitious, family man. Box 49-W, c/o WORLD OIL, Houston, Texas.

BUSINESS OPPORTUNITIES

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY
P. O. Box 1628 — 146 Allen Building
Hobbs, New Mexico — Midland, Texas
Phone 3-3141 — Phone 2-2962

OIL & GAS LAW

SPECIAL SERIES OF SIXTEEN LECTURES

Begins January 27, 1955
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Mimeographed copies of previous lecture series are available at $7.50 per copy. Also available at $5.00 per copy "A Short Summary of the Law of Oil and Gas" by D. H. Gregg, Legal Department of the Humble Oil & Refining Company.

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HOUSTON, TEXAS

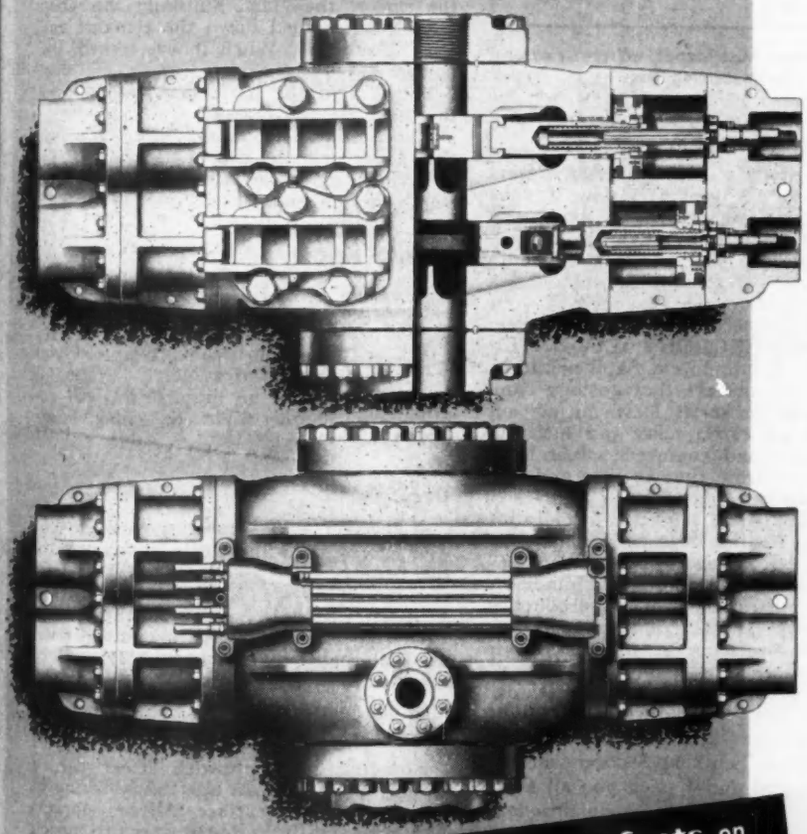
POSITION WANTED

■ SALES & PUBLIC RELATIONS EXECUTIVE desires position with drilling, exploration or supply firm interested in top level representation in Fort Worth and contiguous territory. Box 50-W, c/o WORLD OIL, Houston, Texas.

Before you Invest— INVESTIGATE!

See why SHAFFER *offers more in Hydraulic Cellar Control Gates!*

Before you put your money on the line for pressure control equipment, we invite you to make a point-by-point comparison of the advantages Shaffer offers — *basic* advantages that assure greater convenience and efficiency on every phase of cellar control gate protection.



(Above) **CUTAWAY VIEW**
Showing direct hydraulic drive and self-draining ram compartments.

(Below) **REAR VIEW**
Showing simplicity of hydraulic manifolding for operating the gate.

Get the facts on Shaffer advantages from your nearest Shaffer representative — or write direct for your free copy of the complete Shaffer catalog!

More Compactness!

In all three dimensions—height, width and length—Shaffer Hydraulic Cellar Control Gates are unusually compact.

Furthermore, since the rams are changed through patented side-opening doors, no extra space need be allowed above the gate — or at the ends — for servicing the rams.

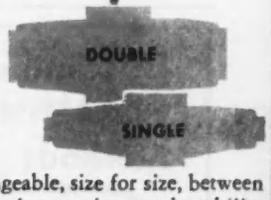
Result — even in sizes as large as 13⅜" (12" Series 900) the gate has a *total* required height of only 30". *No extra space above or at the ends is necessary!*

More Convenience!

Rams in Shaffer Hydraulic Cellar Control Gates are easily changed through patented *side-opening* doors. Simply unbolt and swing open the door... change rams... and bolt the door shut again. Closing the door automatically aligns the rams within the gate.

With Shaffer Hydraulic Gates there's no need to dismantle the upper compartment to change rams in the lower compartment — or vice versa. You can change rams in *either* compartment without in any way disturbing or disconnecting the other, because each is completely independent.

More Versatility!



Shaffer — and *only* Shaffer — provides a choice of either *Single* or *Double* Hydraulic Gates, whichever best meets *your* requirements. Rams and most other parts are interchangeable, size for size, between Single and Double Gates, assuring maximum adaptability to *your particular* needs — at minimum inventory and maintenance costs.

More Efficiency!

Only Shaffer provides the added protection of *Self-Draining Compartment Bottoms*, with rams traveling on high guide ribs where no detrimental mud or sand can accumulate. Also, such important Shaffer features as *Direct Hydraulic Drive* (no yokes or complicated secondary connections between rams and hydraulic pistons) ...*Completely Enclosed Design* (no exposed moving parts to jam or corrode) — and still other advantages make Shaffer Gates the most dependable, most efficient available.

Remember—*For those desiring mechanically-operated equipment, Shaffer also manufactures a complete line of* Mechanical *Cellar Control Gates—both Single and Double Types. Ram Blocks and Ram Rubbers for Shaffer Mechanical Gates are interchangeable, size for size, with those used in Shaffer Hydraulic Gates, assuring further savings where both Hydraulic and Mechanical Gates are used.*

See The Shaffer Section of Your Composite Catalog!

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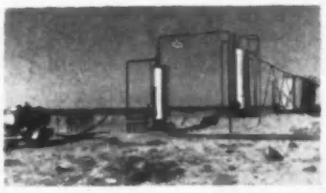

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SQUEAKS from the BULLWHEEL

"In this business, Miss Stendt, we're very careful about starting fires."

November 2, 1954

Deer Publisher World Oil:

I aint writyou a letter for many years and I would not writ you now if your young editors*—shades of the boys who started the rag at Brenham in 1916—would only keep history strate. Where's Cleo? but to get offen wimmen and sex and back to history at page 93 of your issue of November first you have a item SALT DOME GEOLOGY MAY ENTER NEW PHASE etc etc etc. Well not to be critical I may observe that geology wont enter a new phase at least during our lifetime baring earthquakes and such but the geologists and engineers might learn somethin new from time to time and that will certainly be a phase but to get back to history your articul says that exploration on piercement tipe salt dome has been marked by 3 stages of advancement: 1 discovery of oil in caprock at Spindletop in 1901; 2 discovery of flank production at Spindletop in 1925; 3 the penetration of the salt overhang at barbers hill in 193o.

I wrote you a letter which you printed in Squeeks from the Bullwheel on August 8, 1932, at page 72, instead of the Scientific and deep Thinking Section where it reeley belonged and I toled you all about the domes where salt was gone thru long before Barbers hill in 1930. As for item 2 of the list Vinton produced big from flank sands in 191o and thereafter and their was sum flank production at Spindletop befor 1925. One out of threee is good enough for faks for whatehell do they amount to anyhow.

I am getting old from reeding borrowd copies of the Oil Weekly for nearly 40 years and myroyality check from Goosecreek is down to 86 dollars a month but Sid Richyson let me have a five now and then and prosperity is still around the corner. But what I am writin you about —6 is CleO still alive?

Sidney Strong

The Welcome Sign

A man brought a cocker spaniel to a vet and asked him to cut off the dog's tail. "I want it all off," he said, "so that not even a hair of the tail remains."

"Sorry," the vet replied. "I can't do that. Why do you want to cut the tail from an innocent little dog?"

"My mother-in-law is visiting us next month," the man replied, "and I want to eliminate any possible sign or indication of welcome."

No Taste

"A double-dry martini," snapped the visitor to the bartender. The drink was served and the bartender was astounded to see him toss the contents over his left shoulder and then proceed to nibble off the rim of the glass. Finishing this crisp morsel, he slapped down the remains and said, "Another!" When it was served, the performance was repeated.

"Say," said the bartender leaning over the bar, "are you crazy?"

"No," said the man snappily, "It's just that I like only the rim of the glass."

"What!" cried the bartender, "Why, the stem's the best part!"

Didn't Know

A young bride of three months complained to her relatives about her husband's continued drinking habits.

"If you knew he drank, why did you marry him?" she was asked.

"I didn't know he drank," the girl replied, "until one night he came home sober!"

Drought

A stranger, while traveling through Arizona, noticed the dry dusty appearance of the country. He asked, "Doesn't it ever rain here?"

"Rain? Rain?" questioned the native. "Why, say friend, there's frogs in this town over 10 years old that haven't learned to swim yet."

Cause of Courtesy

Standing in a crowded street car, a rather buxom woman was vainly trying to find a token for carfare. All her pockets had been tightly buttoned as a precaution against pickpockets, and no little commotion resulted.

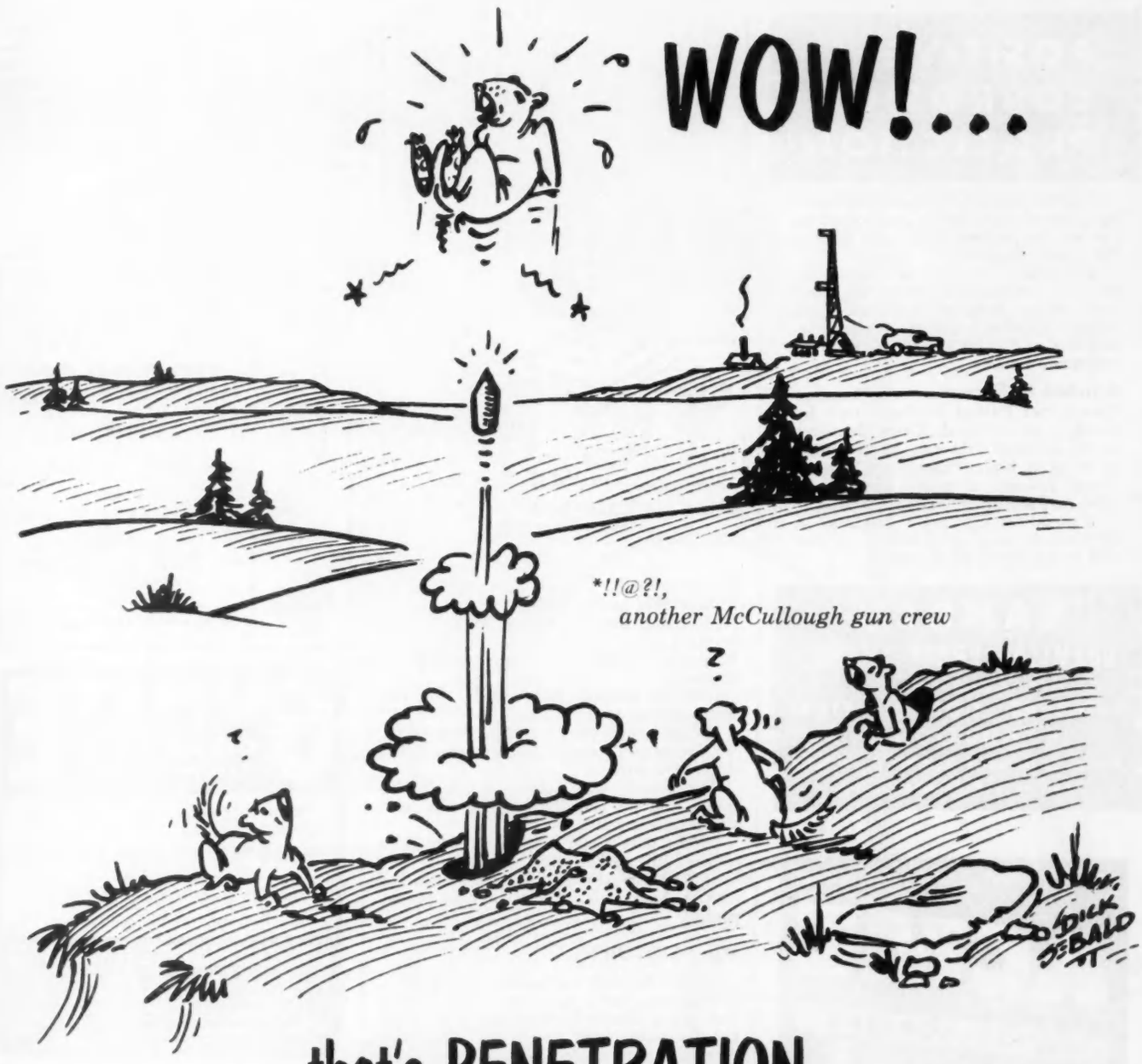
"Please let me pay your fare," said the man beside her.

"Nothing of the kind," she replied, continuing the search. "I've got the fare here some place."

"I'm sure of it lady," said the man, "but I'd like to pay your fare. You've unbuttoned my suspenders three times already."

All Alone

Four old cronies were seated around a table in the back room of the general store, apparently playing poker, as the



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This new and amazing coating resists the destructive effects of nitric acid, picric acid, hydrochloric acid, brines, alkalies, refinery crudes, detergents and even a 50% solution of sulphuric acid.

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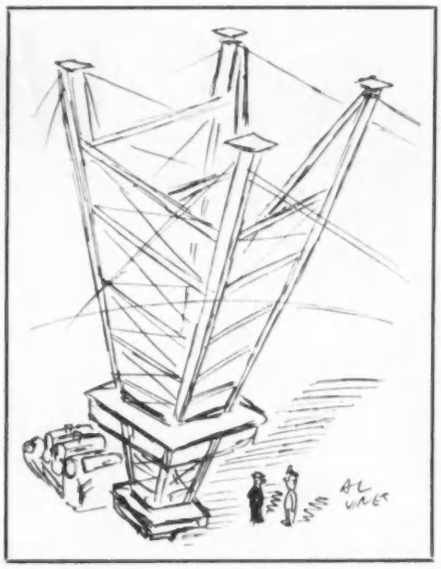

"This is a fine time to tell me you've never set up a derrick before."

sheriff entered.

"Gamblin' again, eh?" he accused.

"Not me, sheriff," one replied, "I just dropped in for some talkin'."

"You're playin'," the sheriff said to another.

"No, sir, sheriff," he replied. "I'm just here warmin' at the stove."

"What about you?" a third was asked.

"Not playin', sheriff, just visitin'," the old fellow said.

The fourth was holding cards in his hands, and the sheriff turned to him with a triumphant smile.

"Well, here's one who can't deny he's playin'," the sheriff said.

"Me playin', sheriff?" the old gent asked with a hurt look. "Who'd I be playin' with?"

Mink's Hi-Jinks

When the little mink died and went to Heaven, St. Peter told him, "We haven't had any minks up here before, so we don't know exactly what to do for you. However, you were a good little mink on earth and we want you to be happy, so we will give you anything you want."

"Please, St. Peter," pleaded the little mink, "could I have a coat made out of chorus girls?"

Nickname

There was a man who called a spade a spade until he stumbled over one in the dark.

Historical Background

The Ark sprang a leak during the great flood. Noah sent his dog to stick his nose in the hole. The hole grew larger and larger. Noah sent his wife to stand over the leak and stop the icy waters. The hole grew still larger. Noah, himself, went below and sat over the hole, which now was of immense proportions. And that, gentle reader, is why a dog's nose is always cold, a woman's feet are always cold, and also why men always stand with their backs to a fireplace.

The Last Word

The office skeptic says that marriage is an institution which teaches a man thrift, regularity and many other splendid virtues he wouldn't need if he stayed single.

There is also considerable wisdom in the words of a small boy writing answers to an anatomy test: "Your legs is what if you ain't got two pretty good ones, you can't get to first base, and neither can your sister."

Definition

Hypocrite: An undertaker trying to look sad at a $3,000 funeral.

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NEW GRIFFIN "NO SWAB" TESTER - ONLY $75*

SAVE DOLLARS - NOW FOR THE FIRST TIME YOU CAN DO YOUR OWN TESTING - ECONOMICALLY BY USING YOUR OWN PACKER, YOUR CREWS AND THE GRIFFIN NO-SWAB TESTER. NO SPECIAL SERVICES REQUIRED.

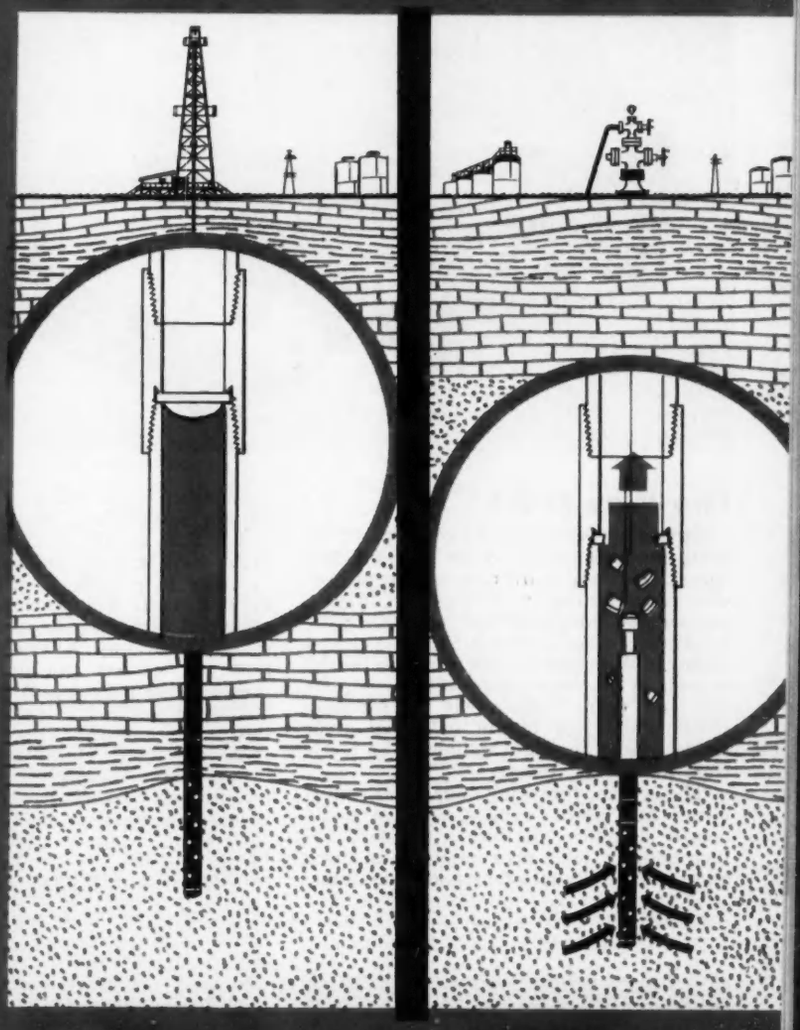
FOR TESTING OR FINAL COMPLETION

After perforation, the Griffin "No-Swab" Tester is installed on the tubing and is positioned at the desired spot in the tubing string to regulate hydrostatic pressure against the reservoir. When the well is ready for the disc to be sheared, simply drop the special Griffin "go-devil." You're in business. The fluid from the reservoir then is free to flow.

FOR PERMANENT TYPE COMPLETIONS

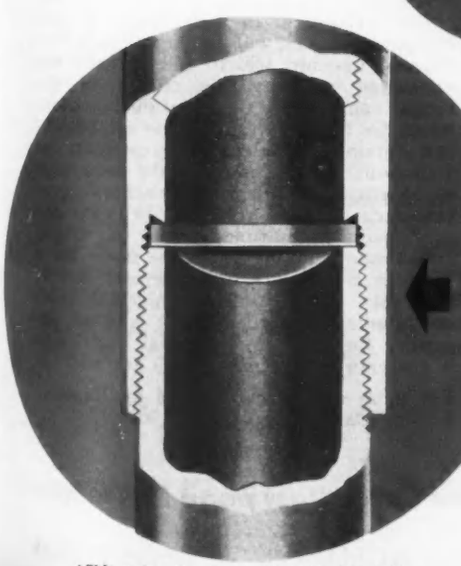
The Griffin "No-Swab" Tester can be used to advantage by installing it in the tubing or on the end of tubing string and when tubing is in final resting position, the disc can be sheared so that when the small tubing perforator perforates the well, the hydrostatic pressure has already been regulated against the reservoir and the well is free to flow without damage to the well.

A used "No-Swab" Tester can be returned for reconditioning service and a replacement purchased for only $50.00. Available through all supply stores.



CONTROL FLOW—This view shows Griffin "No-Swab" Tester in place in tubing with hydrostatic pressure regulated.

REDUCE SWABBING COST—The special "go-devil" has sheared disc allowing well to flow without swabbing. Saves rig time and swabbing cost.



A special alloy disc, capable of resisting high pressures, is the heart of the unit. This disc is tested to 10,000 psi and is secured to a specially designed assembly with the same O.D. as the O.D. of tubing collar. A special knife in the "No-Swab" Tester, in combination with the Griffin "go-devil," is designed to cleanly shear the disc and leave the "No-Swab" Tester with the same I.D. as the tubing. The "go-devil" is made of drillable material and has a special fishing neck.

*This price for 2 or 2½ EUE API tubing. Prices on other sizes and special threads

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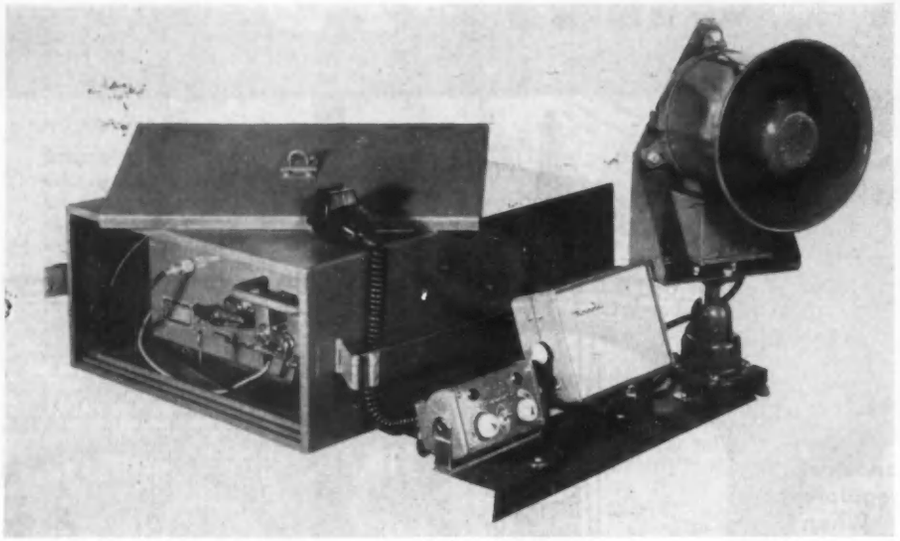
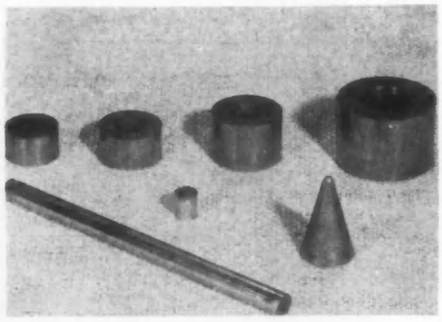


Two-Way Radio

Operating flexibility and extra power to overcome high audible noise levels are two characteristics of a low cost, packaged two-way radio system recently placed in production by Motorola for use in repair trucks or other vehicles. It provides a means of directing a work crew's activities as well as communicating with headquarters and other vehicles. It is especially recommended for use in industrial areas characterized by high audible noise levels from machinery, trucks.

The system, consisting of receiver, transmitter and power supply with an audio booster amplifier, fits into a standard 15-inch housing, takes up a minimum of space and is easily installed. It operates interchangeably with either a six or 12-volt battery installation. Audio output is ten watts; R.F. output is 25 watts. The basic radio may be easily modified or added to in order to provide a custom installation at low cost. For example, it can be equipped with a weatherproof housing and shock mountings. A swivel-mounted marine-type speaker can be substituted for the fixed-position one. A cab speaker can be added to enable the user to connect into the circuit either cab speaker, marine speaker or both. Or, if desired for special installations, a multiple speaker system utilizing up to five of Motorola's new, inverted cone-type speakers can be had.

For more data circle **No. E1** on Readers' Service Card, last page this issue.



Tungsten Carbide Castings

The Carbide Manufacturing Company has announced that it can produce on a custom basis precision tungsten carbide castings of parts that are to be subjected to severe abrasion or erosion. By holding tolerances not heretofore considered practical for production of tungsten carbide castings, the Carbide Manufacturing Company makes possible the production of parts previously considered impossible.

One example of such a product is the six-inch flow bean for oilwell chokes shown in the foreground of the illustration. The small hole is cast through the entire length of the bean within the close tolerances required for oil field chokes. Among the other parts cast of tungsten carbide are, illustrated, needle valve points for adjustable chokes, P-type inserts for Christmas tree chokes and slush nozzle inserts for jet-type drilling bits. Not illustrated are such items as valves and seats in a variety of sizes and styles. Special corrosion resistant alloys are available if required.

For more data circle **No. E2** on Readers' Service Card, last page this issue.

Torque Converters

A complete line of "Torcon" torque converters for application in heavy-duty off-the road, vehicles as well as for stationary power plants used in construction, logging, petroleum and other fields is being produced by Clark Equipment Company's Automotive division. Torcon units are available in 11, 12, 13, 14, 15, 16, 17, 18, 19 and 26-inch wheels. Of the single stage type, the Torcon line includes rated capacities from 30 to 600 horsepower.

The basic package consists of a standard, mass-produced, heavy-duty torque converter that is available "off the shelf" to engine and original equipment manufacturers, as well as to operators who want up-to-date equipment. Basic accessories included with the unit are a pump, cooler and pressure regulator.

An important optional feature offered on the Torcon converter is a "free wheel" mounting for the stator or reaction member. This arrangement gives the unit the combined advantages of the torque converter and fluid coupling. Under load, it provides the desired torque multiplication. When the load decreases, and the speed increases, the torque multiplication drops to one and the unit acts as a fluid coupling. As a result advantage can be taken of 90 percent of an engine's speed-horsepower range, as compared with 75 percent for converters without this feature. The "free-wheel" feature is recommended for equipment operating at low load and high speed for an appreciable part of the daily work cycle.

The operating characteristics of the Clark torque converter units are matched to those of the engines with which they will be used. They are designed to hold the engine within a narrow range of operating speed and torque load. As a result engine wear and tear is kept at a minimum. The range chosen is most efficent operation-wise for both the engine and the torque converter. The torque converters have a high stall torque ratio of 3-1.

For installation in a particular line of equipment, Clark will design and build the housing or case which will include the means of coupling the output of the torque converter to the input of the equipment. In this way, an equipment builder can obtain a complete unit ready for installation in his product in the same way as an engine or other component. A general-purpose case also can be provided that permits multiple means of torque transmission. Provision can be made for a lock-out clutch, dry or disconnect clutch; sprocket; pulley; flange - universal joint combination; industrial shaft without accessory drive; or an industrial shaft with a governor or accessory drive output.

For more data circle **No. E3** on Readers' Service Card, last page this issue.

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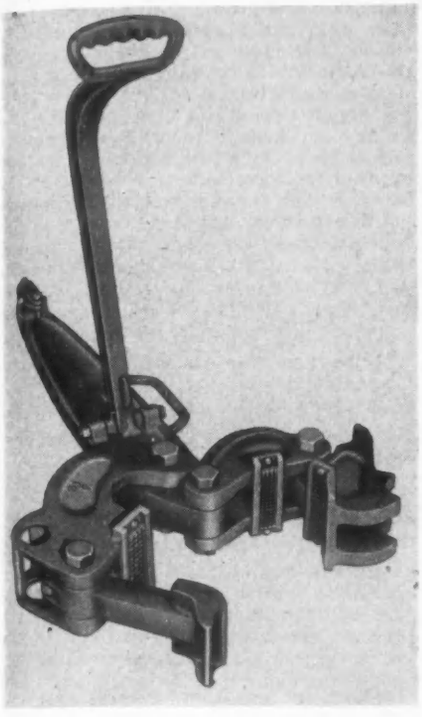


Rotary Tongs

Two new types of rotary tongs—Type "F" for blitz rigs, portable masts, water well rigs, production workover rigs and other light rotary work and Type "LF" for portable shot hole, exploratory, geophysical, water well rigs, production service and extremely light tong requirements —are being produced by Byron Jackson Co.

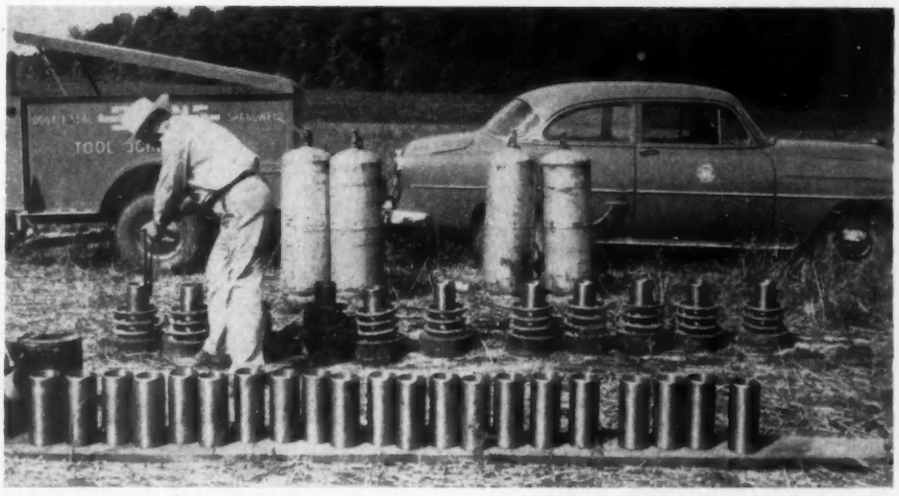
Especially designed for lightweight rotary rigs, Type "F" is a light but rugged three-jaw tong with jaws and lever of cast alloy steel, BJ-heat treated for extra strength. Threaded type hinge pins (1¼ inch) and slotted nuts are used to prevent the female hinge section from spreading and bending the pin. All hinge surfaces are machined for smoother operation and longer life.

Positive latching is assured by a tee-type latch with convex surfaces which contacts the concave lugs in the jaw and prevents the tong from unlatching when tonging. The popular BJ "Gooseneck" hanger with easy longitudinal and lateral adjustment makes for perfect suspension, giving perfect balance. Six lug jaw sizes provide a pipe-handling range from 2⅜ inches to 10¾ inches. Approximate weight of Type "F" Tong is 178 pounds.

Type "LF" Tong is almost identical in construction except it is smaller and weighs only 115 pounds. Jaw and lever construction is the same as Type "F" and all hinge surfaces are machined.

(This item supplements Byron Jackson Company data on pages 993-1044 of the Composite Catalog, 20th Edition.)

For more data circle **No. E4** on Readers' Service Card, last page this issue.



Steel Frame Trailer

A simple trailer, carrying portable furnaces and other equipment, enables Elmer J. Daman to save much time in replacing worn-out tool joints for drillers in the Illinois, Indiana, and Kentucky oil fields.

Daman, tool joint serviceman for The National Supply Co., finds it quicker and easier to do his work at the drilling rigs, rather than to ship the heavy drill pipe back to a central shop to change the joints. Often the work can be scheduled for times when the pipe is not needed for drilling, thus avoiding any delay or inconvenience to the drilling contractor.

The steel-frame trailer carries 11 portable ring-type furnaces, and four 100-pound propane gas tanks, as well as electric buffers, a 500 foot extension cord, spanner wrenches, and other tools.

The furnaces weigh only 37 pounds each and will heat a tool joint in less than five minutes. They are coupled in series of three to the four gas tanks, which provide sufficient gas for rejointing approximately 120 lengths of drill pipe.

Many of the tool joints serviced are of the "shrink thread" type, applied originally at the pipe mill where each joint is heated to expand it, then allowed to shrink over the pipe, making a tight connection. Daman uses an oxy-acetylene torch to remove the worn-out tool joints, cleans the pipe ends and tool joints, and then uses the furnaces to heat the new tool joints to the proper temperature so that they can be applied to the pipe.

(This item supplements The National Supply Company data on pages 3589-3720 of the Composite Catalog, 20th Edition.)

For more data circle **No. E5** on Readers' Service Card, last page this issue.

Engine Water Filter

Detroit Diesel Engine Division of General Motors has announced the availability of a new engine water filter as an optional accessory on Series 51, 71 and 6-110 diesel engines.

Through the use of mechanical filtration, inhibitors and resistor plates, the filter removes impurities from the cooling system, softens the cooling water and controls alkalinity, rust formation and electrochemical action.

The unit contains a replaceable filter element which is to be renewed at regular intervals depending upon the chemical composition of the cooling water. In the event the element becomes clogged, water bypasses the filter and no filtering action takes place until the element is replaced.

The filters are easily installed and range from 3½-inch to five inches in diameter and from six inches to 7½ inches in height.

(This item supplements General Motors Corporation, Detroit Deisel Engine Division data on pages 1349-1355 of the Composite Catalog, 20th Edition.)

For more data circle **No. E6** on Readers' Service Card, last page this issue.

Drilling Mud Compound

A new oil well drilling mud compound, said to cut drilling time by at least ten days from the average time previously required for wells of similar depth and location, has been introduced by Monsanto Chemical Company's Organic Chemicals division.

The new material, called Filcon SPF, stabilizes the viscosities and gel strengths of drilling muds by a new principle, according to a company bulletin describing the product. It also helps to reduce water loss in all types of mud. No unusual mixing techniques are required for its use.

An average drilling rate of 182.2 feet a day was achieved in the five approxi-

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mately 10,000-foot test wells in the Glendive, Mont., area of the Williston Basin. Filcon SPF and carboxymethyl cellulose were used to treat high pH muds to drill through the red beds and salt stringers in the area.

Although salt concentrations varied from 2300 to 9600 ppm, mud properties remained stable and the holes were in excellent condition at all times, according to the bulletin reporting performance data. Mud costs per foot averaged $0.906.

It is estimated that drilling time may be cut by at least 10 days from the average time required with other mud types, such as gyp and lime. Filcon SPF is especially recommended in drilling salt or anhydride sections, since it is more tolerant of calcium sulfate and salt contaminants than unstabilized muds. A high molecular weight sulfonated phenol formaldehyde resin, Filcon SPF is available in 50-pound moistureproof bags.

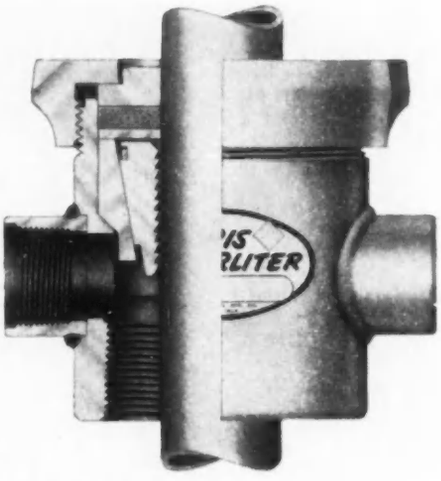
For more data circle **No. E7** on Readers' Service Card, last page this issue.

PRODUCTION

PVC Valve and Fittings

The Lunkenheimer Company has announced the first all molded PVC valves and fittings. This line has been patented and registered under the name "Luncor," which refers to its resistance to corrosive chemical action. The "Luncor" valve will be marketed at a price lower than stainless steel and other alloy valves. Base material used for the new valve is polyvinyl molded in rigid form, suitable for presform of corrosion-resistant piping. It is molded in rigid form, suitable for pressure up to 125 pounds and 150 degrees temperature. The valve is presently available in a Y-type globe design. A complete line of plastic fittings made of the same material is also available from Lunkenheimer. These include caps, couplings, plugs, unions, reducing bushing, flanges, 45-degree and 90-degree elbows and tees.

For more data circle **No. E8** on Readers' Service Card, last page this issue.



Tubing Head

Rated at 1000 cold working pressure, the Type WCN head is adaptable to fracturing, acidizing, repressuring, waterflooding, and various other completion and production methods.

Full opening, equipped with slips to suspend two-inch or 2½-inch tubing, the WCN head is furnished in 5½-inch female casing size, with two two-inch side outlets. It is also available in seven-inch male casing size. The over-all height of the 5½-inch head is 8⅜ inches; the 7-inch head, 10⅞ inches. The adjusting cap provides a broad tubing spider base. The Type WCN head is manufactured by W. C. Norris, Manufacturer.

(This item supplements W. C. Norris, Manufacturer, Inc., data on pages 3665-3676 of the Composite Catalog, 20th Edition.)

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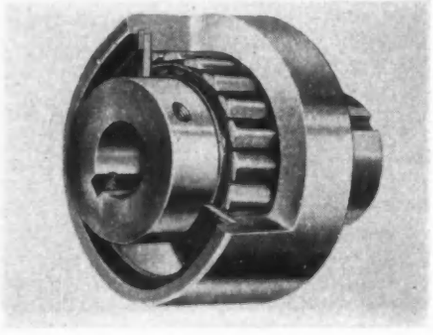

Cam Clutches

A new line of low-cost, plain bearing cam clutches for indexing overrunning and backstop applications is announced by Morse Chain Company. Called the PB series, these cam clutches are ideal for applications in a variety of machinery drives where economical, trouble free operation is desired.

Morse PB series clutches are basically designed for operation in the lower speed and torque ranges and can be used in conjunction with standard shafting on press feeds, two-speed drives and as backstop and overrunning clutches in machine drives.

These self-contained units include long bronze bearing hardened and ground steel inner and outer races, a full complement cam and energizing spring assembly, a snap ring, and a grease fitting for lubrication. The clutches are prelubricated at the factory. The hardened ball bearing steel cams feature a constant pitch spacing design that avoids cam crowding and single cam locking conditions. Shape of the cams is such that they cannot roll over under overload or peak torsional loads. A flat contour beyond the locking position contacts the outer race at loads above normal capacity rating and prevents the cams from injuring the races or damaging the energizing springs. The contact angle is designed to prevent the cams from skidding out under load.

(This item supplements Morse Chain Company data on pages 3574-3579 of the Composite Catalog, 20th Edition.)

For more data circle **No. E10** on Readers' Service Card, last page this issue.

Automatic Shut Off Valve

The L-K automatic shutoff and back pressure valve fills a need for a positive automatic shutoff valve. This shutoff feature also combines with it a positive back pressure check valve. It is designed for use in running oil from lease tanks or batteries into main lines or stock tanks and automatically shuts off when the fluid that is being run out reaches a predetermined level. In operation it is set on the flow line a short distance from the tank or battery it is to serve. Weights applied to the valve offset the static pressure of the oil within the tank so that when the oil in the tank reaches a predetermined level where the static weight of the oil flowing through the valve is less than the weight on the valve, the weight closes the valve. A piston working inside a cylinder above the valve and having an extension resting on top of the valve serves the purpose of balancing the vacuum on the downstream side, the downward pull of the vacuum on the piston and the upward pull on the valve offsetting each other. This permits the differential weight bearing down on top of the valve through the piston to close the valve, when the pressure from the tank becomes less than this weight. As this valve is closed, it immediately becomes a back pressure valve.

Manufactured by the L-K Pump Valve Company, this valve does not restrict the flow, the four-inch valve having an orifice of seven square inches. It has worked satisfactorily with a centrifugal pump handling 250 barrels per hour; also with a tank battery having an elevation of about 250 feet above the main line. This valve is not complicated; it can be opened with a pair of pliers or a screwdriver and all the working parts removed in less than two minutes. The four-inch standard valve is built for 300 pounds working pressure and is tested to 1000 pounds.

(This item supplements L-K Pump Valve Company data on pages 2870-2879 of the Composite Catalog, 20th Edition.)

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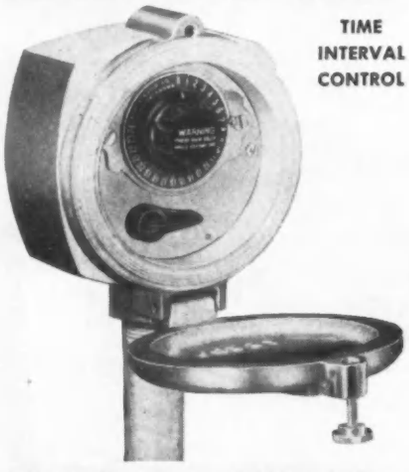

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Model TYC 101

Spring-wound, 24-hour movement (which cannot be overwound) actuates mercury switch. Designed for simplest trouble-free operation. Enclosed in weather-tight housing.

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New Equipment Literature

Pipe, Fittings and Valves

Complete technical data on "Dur-Ace", a new general-purpose corrosion-resistant plastic pipe are given in a bulletin announced by American Hard Rubber Company. General properties of the multi-polymer rigid plastic pipe, together with chemical resistance tables, standard sizes, pressures and prices of pipe, fittings and diaphragm valves are included together with installation and fabrication data. This product is a new multi-polymer thermoplastic, light in weight, odorless, tasteless and non-contaminating.

To get a copy, circle **No. E12** on Readers' Service Card, last page this issue.

Mudline Valve

Operators, toolpushers and crew men on oil drilling rigs can obtain prolonged trouble-free service from "Mudwonder" mudline valves by following instructions described and illustrated in a new bulletin published by Edward Valves, Inc.

Besides procedures to be used in maintenance, the 16-page booklet shows a detailed description of each part and its function. Typical erosion patterns for parts used in field destruction tests are also pictured to give the new purchaser an idea of what he can expect from his "Mudwonder" valves.

The "Mudwonder" was officially introduced to the oil drilling industry for 2000 psi WP (4000 test) and 3000 psi WP (6000 test) only this past spring after 21 months of field testing on rigs in Oklahoma, Texas and Louisiana.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Fluid Couplings

A new bulletin giving installation and performance data on fluid couplings has been released by Twin Disc Clutch Company. The new bulletin shows the ease of applying Twin Disc fluid couplings on any type industrial equipment, powered by any type electric motor or internal combustion engine from three-fourths to 850 horsepower. In addition, the complete Twin Disc fluid coupling line is shown, with standard models providing standard input, output combinations, and standard models in packaged units. All the installation hookups provided by the variety of fluid couplings are given with typical on-the-job applications in various industries.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Automatic Blow Cases

Black, Sivalls & Bryson, Inc. announces the publication of a catalog on automatic blow cases—gas powered high volume pumps that are completely automatic and operate on either air or gas. The unit receives liquid at low pressure and discharges it at pressures up to 2000 pounds per square inch.

Designed for oil field production use, the BS&B blow case has three main applications: (1) as a booster pump to prolong the flowing life of a well, (2) in stage separation where it permits the second or third separator to operate at pressures as low as three to four pounds, and (3) as an automatic drip on low pressure gas lines.

The new 4-page catalog section also gives fluid capacities and solves a sample problem on how to determine power gas requirements.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Service Booklet

A new service booklet, "Protection for Your Profits," has been released by Caterpillar Tractor Company. This publication is to help equipment owners acquaint themselves with the latest service equipment, preventive maintenance practices, and methods that may be utilized to speed up emergency field service.

To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

Automatic Regulators

A four-page bulletin issued by Atlas Valve Company contains illustrations on 12 basic control valve types frequently used by the marine and chemical process industries, power generating facilities, and for numerous liquid or gas pressure control applications requiring precise instrumentation by means of automatic regulators. Among the equipment described are two spring loaded, diaphragm-operated and externally controlled steam reducing valves, two automatic valves for air, water or oil and a combination high pressure reducing and relief valve. Other basic types include a weight loaded, lever operated control valve for water, oil, gas or steam, an auxiliarly operated float valve, a cam and lever control valve which is piston operated and internally actuated and two versatile spring loaded regulators for temperature and pressure control.

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THE LAYNE Gravel Pack

The ONLY Method of Gravel Packing With Circulation

Gravel Packing is a subterranean engineering problem and has been a Layne specialty for years. Each well requires individual treatment. Successfully applied to thousands of wells at all depths, Gravel Packing has proven conclusively it will control sand, when other methods have failed.

The Layne patented method of gravel packing is with circulation. The gravel and well are under control at all times. This method was developed and perfected after years of actual field experience and extensive research.

Layne Gravelling Equipment consists of specially designed high pressure mixing drums, pump, manifolds, control valves, etc., assembled into a unit and mounted on a truck. For off-shore jobs the unit is mounted on skids. The gravel is measured when placed in the drums and mixed with fluid, then deposited in the well under pressure.

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New Books, Maps and Movies

OIL AND PETROLEUM YEAR BOOK, Walter E. Skinner, 20 Copthall Avenue, London, E. C. 2. $5 post free abroad.

The forty-fifth annual edition of this standard reference work, compiled by Walter E. Skinner, has just been published. Complete and up-to-date particulars are given concerning 945 companies operating in all parts of the world and covering all branches of the oil industry, together with a list of names and addresses of 628 managers and engineers and the companies in the book with which they are connected. The book contains information on the principal British, American, Canadian and foreign companies. The particulars of each company comprise names of directors and other officials, description of business, where operating, crude oil production, refinery runs, details of capital, dividends and financial results. The Buyers' Guide of Manufacturers of oil field and refinery equipment comprises 875 headings.

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PETROLEUM FACTS AND FIGURES, Eleventh Edition, American Petroleum Institute, 50 West 50th Street, New York 20, N. Y.

This volume brings together a wealth of statistical data about the oil industry. It is hoped that oil men, students, educators, journalists, economists, and others interested in the history and operations of the oil business will find the book an authoritative work of reference. With the ninth edition, the present volume provides a statistical history of the oil industry dating from the earliest years for which comparable information is available. Where no new information is available, tabulations appearing in the ninth edition have not been repeated. In all other instances, the new edition supplements and brings up to date the earlier record. Flow charts on marketing and data on petrochemicals and employment trends appear for the first time while coverage of offshore operations and sales of lubricants has been widely extended.

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AAPG BULLETIN, Vol. 1, 1917, reprinted by Gulf Publishing Company. Copies of this printing available through Cambe Log Library, 328 Esperson Building, Houston, Texas. $10.

Volume I of the AAPG Bulletins has been privately printed by a group of Houston geologists to complete their sets. Bound in green buckram and gold imprinted, the volume is available from the above address. This has long been a collectors' item. There were only 175 AAPG members in 1917, and there are 12,000 now. At its first printing, the bulletin sold through used shops for as high as $50 for paper bound volumes. A complete set of the bulletins is valued from $1200 to $1500.